Plankton Dynamics in Bedford Basin, Nova Scotia: Carbon Flux in Feeding Experiments with Micro- and Macrozooplankton from February 13, 1978 to January 31, 1979

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Le titre exact paraît au haut du résumé de chaque rapport.

Canadian Data Report of Fisheries

and Aquatic Sciences No. 392

PLANKTON DYNAMICS IN BEDFORD BASIN, NOVA SCOTIA: CARBON FLUX IN FEEDING EXPERIMENTS WITH MICRO- AND MACROZOOPLANKTON FROM FEBRUARY 13, 1978 TO JANUARY 31, 1979

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ABSTRACT

Cota, G.F. and Harrison, W.G. 1983. Plankton dynamics in Bedford Basin, Nova Scotia: Carbon flux in feeding experiments with micro- and macrozooplankton from February 13, 1978 to January 31, 1979. Can. Data Rep. Fish. Aquat. Sci. No. 392: iv + 67 p.

Net flux rates of organic carbon were measured or estimated for several carbon pools in a series of feeding experiments on natural particle assemblages from Bedford Basin over a seasonal cycle. Two planktonic systems based on particle size (with and without small late-stage copepods) were compared to assess the relative consumption rates of natural particulate matter by the various sizes or types of zooplankton. The particulate resource regime of zooplankton in the experiments was also characterized seasonally in terms of particle size distribution, absolute and relative abundance of particulate organic materials, and abundances of the more obvious forms of microzooplankton.

RESUME

Cota, G.F. and Harrison, W.G. 1983. Plankton dynamics in Bedford Basin, Nova Scotia: Carbon flux in feeding experiments with micro- and macrozooplankton from February 13, 1978 to January 31, 1979. Can. Data Rep. Fish. Aquat. Sci. No. 392: iv + 67 p.

Les flux nets de carbone organique de plusieurs réservoirs de carbone ont été déterminés ou estimés au cours d'un cycle saisonnier lors d'une série d'essais d'alimentation portant sur des ensembles de particules naturelles du bassin Bedford. On a comparé deux systèmes planctoniques, basés sur la taille des particules (avec et sans petits copépodes de stade avancé) afin d'évaluer les taux de consommation relatifs de la matière particulée naturelle par divers types et tailles de zooplancton. Le régime particulé du zooplancton a aussi fait l'objet d'une caractérisation saisonnière portant sur la distribution des tailles des particules, l'abondance absolue et relative des matériaux organiques particulés et l'abondance des formes de microzooplancton les plus apparentes.

INTRODUCTION

This is the second in a series of data reports presenting results of experiments on seasonal plankton dynamics (1978-1979) for natural populations from Bedford Basin. The first report (Irwin et al., 1981) dealt with phytoplankton dynamics in concurrent experiments at the same location over a slightly longer time period. The present study examines the potential resource regime of micro- and macrozooplankton and their apparent feeding dynamics in natural particle suspensions. Net flux rates of material in several organic carbon pools were estimated as well as standing stocks of these resource pools. Relative rates of consumption of nonliving and living resources were of special interest. The agents or processes mediating these fluxes are not always obvious; a detailed discussion with conceptual and statistical interpretations of these results can be found in Cota (1983).

Preliminary studies (11 experiments) were made in 1977. We present the results from 26 feeding experiments in this report. Various other aspects of this system have been studied previously (e.g., Conover, 1978; Hargrave and Taguchi, 1978; Irwin et al., 1981; Mayzaud and Taguchi, 1979; Taguchi and Platt, 1977; and references cited in these works).

MATERIALS AND METHODS

Sampling

All samples were collected at the compass buoy, Bedford Basin 44°31.3'N, 63°38.3'W (station 1, Figure 1). Water depth at this location was 71 m. Bedford Basin is a semienclosed marine basin connected to the Atlantic Ocean through the narrow Halifax harbour channel (10 km

long, 20 m sill depth). This basin receives untreated industrial and domestic sewage effluent from an urban community of approximately 55,000 people.

The sampling period spanned a seasonal cycle from February 13, 1978 through January 31, 1979, and samples were collected on roughly a biweekly basis throughout the year, excluding June 1978. Seawater was collected from a depth of 5 m with a 30 liter Niskin bottle. Water from two or more hydrocasts was screened with a 153 µm mesh to remove macrozooplankton, and thoroughly mixed. A single oblique zooplankton tow (333 µm mesh) was made from the bottom of the thermocline to the surface or to a maximum depth of 30 m when the system was nearly isothermal. The zooplankton tow was screened with a 782 µm mesh to remove large carnivores and diluted in 16-19 liters of screened (153 µm) water.

Feeding Experiments

Experiments were set up in triplicate for each of two incubation treatments, with 4 liters of water added to 5 liter glass reagent bottles; water samples for triplicate initial measurements (time equals zero) were taken concurrently from the same reservoir. A flowchart summarizing the experimental design is shown in Figure 2, where the so-called "control" and "experimental" treatments are designated, respectively, as the microzooplankton (µZP) system and the macrozooplankton (MZP) system to emphasize the largest size class of predators present in each case. The MZP system was identical to the µZP system except that a multispecies assemblage of small, late-stage calanoid copepods was reintroduced at densities of 10 or 25 copepods/l.

Temperature was carefully controlled before and during experiments. All bottles were incubated at or near the ambient environmental temperature (5 m) for 24 hours with intermittent rotation in complete darkness.

Final measurements of all parameters were made on samples withdrawn from each of the six incubation bottles through a siphon fitted with a 153 µm mesh to exclude copepods. Copepods were collected on filters and frozen for later reference. All measurements for the three treatments were done in triplicate, except for some of the particle counts (see Tables 1-26 and below).

Particulate Organic Carbon (POC)

POC was normally measured by Wangersky's (1974) method, employing gravity filtrations, 47 mm Whatman GF/C glass fiber filters and double-filtered seawater for rinses instead of distilled water. In four experiments (G-27-G-29 and G-31) Selas Flotronics 47 mm silver filters with a 0.8 µm pore size were used for POC and particulate organic nitrogen (PON) determinations on a model 185B Hewlett-Packard CHN analyser (Sharp, 1974). Samples of 250-1000 ml were filtered onto previously baked (450°C for 3 hours) filters and stored at -20°C in petri dishes.

Particulate Organic Carbon to Nitrogen Ratios (C/N)

C/N ratios are reported on the basis of weight/weight.

Adenosine Triphosphate (ATP)

ATP was analysed by the technique of Holm-Hansen and Booth (1966), implementing the recommendations outlined in Sutcliffe et al. (1976). Samples of 100-500 ml were filtered by vacuum filtration (<5 mm Hg) onto 25 mm filters (Whatman GF/C) and immediately placed into 5 ml test

tubes containing 3 ml of boiling tris buffer. After 5 minutes the tubes were cooled to room temperature then stored at -20°C. ATP concentrations were estimated with an ATP photometer (model 2000, JRB, Inc.) which had been calibrated with a dilution series of purified ATP (Sigma Chemical Co.). A factor of 250 was used for conversion of ATP to total living organic carbon (LOC).

Nonliving Particulate Organic Carbon (NOC)

NOC concentration was estimated as the difference between [POC] minus [LOC] (i.e., NOC=POC-LOC) in paired water samples from the same bottle.

Chlorophyll a (CHLa)

CHLa was measured fluorometrically as described by Holm-Hansen et al. (1965). Samples of 25-250 ml were filtered by vacuum filtration (<5 mm Hg) onto 25 mm filters (Whatman GF/C) and stored at -20°C. Acetone extracts of pure chlorophyll a (Sigma Chemical Co.) were used to calibrate the fluorometer. A conversion factor of 30 was used to estimate phytoplankton carbon (PPC).

Heterotrophic Plankton Carbon (HPC)

HPC concentration was estimated as the difference between [LOC] minus [PPC] (i.e., HPC=LOC-PPC) in paired water samples from the same bottle.

Dissolved Organic Carbon (DOC)

DOC determinations were made on the filtrate of POC filtrations with an ultraviolet oxidation procedure (Gershey et al., 1979). Samples were stored at -20°C in milk dilution bottles with teflon-lined caps.

Total Organic Carbon (TOC)

TOC concentration was estimated as the sum of [DOC] plus [POC] (i.e., TOC=DOC+POC) in a water sample from the same bottle.

Coulter Counts of Particle Size Distribution

Particle counts with a model TA-II Coulter Counter were run on unpreserved water samples as soon as possible after collection; samples were held at the experimental temperature until counting. The "base channel" method of counting was used to improve the statistics of the particle counts (Sheldon, personal communication; also see Sheldon and Parson, 1967; Cota, 1982). Numerical totals for each size class were converted to equivalent spherical volumes and expressed as parts per million (PPM) on the basis of total suspended particle volume per unit volume of seawater, where one PPM equals mm^3/l. Spectra, obtained with two aperture tubes (100 µm and 280 µm diameter apertures), were connected at $\leq$16 µm equivalent spherical diameter (ESD) and $\geq$20.2 µm ESD to yield a single spectrum spanning the size range from 2 µm ESD to 128 µm ESD with 19 size categories for each replicate. The first and last channels from the 100 µm and the 280 µm tubes, respectively, were always discarded.

Estimates of total particle volume (TPV) were obtained by summing over all size classes of a size spectrum (2-128 µm) and they are reported as single values for each replicate count. Replicate counts within each treatment were also averaged by size class to yield mean values of channel particle volume (CPV) for each of the 19 size categories.

Inverted Microscope Counts of Microzooplankton

Direct particle counts, using an inverted microscope, were made on select samples preserved with basic 'Lugols' solution (Utermohl,

1958). In order to economize time and effort, equal volumes of (well-mixed) triplicate samples were combined to obtain a single subsample for each of the initial and the two final treatments. In all cases, a combined subsample of 100 ml was settled for 72 hours. Large particles, such as micrometazoans and larger protozoans were enumerated by scanning the entire base of the settling chamber at 60X magnification with bright field illumination. Small protozoans were counted on two to five 10.2 mm transects at 400X magnification with phase contrast illumination. Total numbers of micrometazoans and protozoans are reported for the initial and the two final treatments. Micrometazoans (<153 μm) were always dominated by copepod nauplii and/or rotifers; protozoans were usually dominated by oligotrich ciliates and/or phagotrophic dinoflagellates.

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ABBREVIATIONS, DEFINITIONS AND UNITS

ATP	adenosine triphosphate
CHLa	chlorophyll a
POC	total particulate organic carbon (0.5-150 μm) (μgC/l)
PON	total particulate organic nitrogen (μgN/l)
C/N	carbon to nitrogen ratio (weight/weight)
LOC	living particulate organic carbon (= ATP x 250) (μgC/l)
PPC	phytoplankton carbon (= CHLa x 30) (μgC/l)
HPC	heterotrophic plankton carbon (= LOC-PPC) (e.g., bacteria, microzooplankton and other heterotrophs) (μgC/l)
NOC	nonliving particulate organic carbon (= POC - LOC) (μgC/l)
DOC	dissolved organic carbon (mgC/l)
TOC	total organic carbon (= POC + DOC) (mgC/l)
μZP	microzooplankton (<200 μm)
META	micrometazoans (<200 μm) (i.e., nauplii and/or rotifers) (#/l)
PROTO	protozoans ($\#x10^3$/l)
MZP	macrozooplankton (200-2000 μm) (e.g., small late stage copepods)
G-x	grazing experiment-number (x)
Flux rate	herein used to denote rates of change (net flux = influx + efflux) of "dissolved" or "particulate" mass of a given type in a volume (not area) of water over a period of time (units = wt/vol/t; e.g., μg/l/hr)
ESD	equivalent spherical diameter (geometric mean of a size class) (μm)
PPM	particle (volume) concentration in parts per million (mm^3/l)
CPV	channel particle volume (19 individual size classes) (mm^3/l)
TPV	total particle volume for entire size spectrum (2-128 μm ESD) (mm^3/l)

TABLE LEGENDS

Tables 1-26. Numerical data for all measurements made in each of the 26 experiments. Abbreviations used in the column headings are listed on page 8; the three treatments (TRMT) are the initial controls, microzooplankton finals and macrozooplankton finals. Average channel particle volumes (CPV) for each treatment are given at the bottom of each table; the ESD of the 19 size classes (2-128 μm) are listed in two rows with the first and second rows including 10 size classes (2-16 μm) and 9 size classes (20.2-128 μm), respectively.

TABLE 1. EXPERIMENT (G-14); DATE 130278

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	213.8	164.2	49.6	26.5	23.1	1.54	1.75	1.48				
CTL	250.3	184.4	65.9	32.3	33.6	1.68	1.93					
	238.9				32.1							
MICROZOO	216.8	149.9	66.9	51.3	15.6	1.43	1.65	1.34				
FINAL	233.3	166.1	67.2	53.7	13.5	1.45	1.68	1.98				
	205.8	137.4	68.4	54.3	14.1	1.56	1.77	1.40				
MACROZOO	263.3	197.7	65.6	47.6	18.0	1.70	1.96	1.45				
FINAL	273.8	197.8	76.0	59.2	16.8	1.54	1.81	1.33				
	223.8	150.8	73.0	53.8	19.2	1.76	1.98	1.49				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.031	.030	.038	.049	.061	.071	.124	.085	.056	.042
CONTROL	.104	.065	.067	.085	.199	.213	.050	.053	.059	
MICROZOO	.057	.044	.049	.066	.076	.081	.103	.153	.103	.064
FINAL	.093	.057	.038	.054	.088	.125	.074	.115	.135	
MACROZOO	.055	.040	.045	.062	.072	.079	.112	.164	.082	.061
FINAL	.066	.039	.029	.045	.123	.135	.055	.068	.092	

TABLE 2. EXPERIMENT (G-15); DATE 200278

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	461.8	345.9	115.9	92.5	23.4	1.55	2.01	2.38	30		63.3	
CTL	404.3	291.5	112.8	91.5	21.3	1.55	1.95					
	400.7	299.8	100.9	82.0	18.9	1.57	1.97					
MICROZOO	270.3	185.6	84.7	61.3	23.4	1.59	1.86	1.80	20		29.0	
FINAL	260.3	190.4	69.9	49.2	20.7	1.53	1.79	1.63				
	285.8	174.6	111.2	86.6	24.6	1.39	1.68	1.73				
MACROZOO	316.8	221.3	95.5	67.6	27.9	1.49	1.81	1.66	20		45.2	
FINAL	248.3	153.6	94.7	66.8	29.9	1.57	1.82	1.74				
	292.3	207.0	85.3	61.3	24.0	1.39	1.62	1.73				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL CONTROL	.059	.037	.038	.052	.066	.088	.218	.376	.187	.101
	.291	.128	.057	.084	.148	.214	.067	.071	.095	
MICROZOO FINAL	.119	.082	.057	.059	.067	.074	.197	.303	.127	.069
	.106	.051	.042	.058	.092	.104	.046	.041	.029	
MACROZOO FINAL	.072	.042	.041	.053	.060	.070	.186	.272	.117	.060
	.165	.060	.043	.062	.098	.141	.040	.051	.079	

TABLE 3. EXPERIMENT (G-16): DATE 27027A

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	469.0	250.7	218.3	140.6	77.7	0.99	1.46	4.44	60		17.4	
CTL	485.3	265.5	219.8	135.5	84.3	0.99	1.48					
	460.1	272.6	187.5	109.8	77.7	0.95	1.41					
MICROZOO	411.6	251.8	159.8	75.5	84.3			3.82	40		10.6	
FINAL	389.9	216.6	173.3	86.0	87.3			4.03				
	424.0	286.7	137.3	62.9	74.4			3.31				
MACROZOO	403.5	255.7	147.8	89.9	57.9			3.42	60		6.8	
FINAL	450.0	289.5	160.5	82.8	77.7			3.19				
	446.9	276.8	170.3	99.2	71.1			3.66				

AVERAGE COULTER COUNTS (PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL CONTROL	.068	.052	.047	.056	.066	.108	.330	.948	.522	.246
	.776	.248	.320	.281	.145	.096	.058	.034	.041	
MICROZOO FINAL	.059	.044	.047	.055	.062	.104	.457	.839	.397	.230
	.228	.132	.240	.120	.158	.192	.114	.109	.105	
MACROZOO FINAL	.063	.047	.050	.065	.065	.099	.326	.910	.509	.276
	.225	.107	.194	.095	.125	.128	.041	.037	.060	

TABLE 4. EXPERIMENT (G-17); DATE 200378

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO PON	C/N
	971.7	614.2	357.5	221.6	135.9	1.27	2.24	15.79	430	3.8	
INIT	878.1	592.1	286.0	195.4	90.6	1.25	2.13				
CTL	911.7	563.7	348.0	234.6	113.4	1.36	2.27				
	861.7	649.4	212.3	111.8	100.5	1.39	2.25	11.25	320	2.6	
MICROZOO	800.2	552.7	247.5	155.7	91.8	1.28	2.08				
FINAL	815.2	592.2	223.0	116.2	106.8	1.30	2.12	12.83			
	796.0	580.0	216.0	109.2	106.8	1.36	2.16	12.55	360	0.6	
MACROZOO	857.4	606.6	250.8	147.3	103.5	1.40	2.26	13.11			
FINAL	805.2	546.7	258.5	161.3	97.2	1.37	2.18				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0	
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0		
INITIAL	.083	.055	.070	.129	.117	.357	1.175	1.544	1.152	.561	
CONTROL	.829	.453	.815	2.506	3.274	1.493	.288	.223	.669		
MICROZOO	.066	.053	.076	.087	.097	.329	1.021	1.101	.678	.299	
FINAL	.579	.462	.981	2.414	2.081	.677	.232	.268	.538		
MACROZOO	.071	.056	.080	.112	.101	.374	1.011	1.072	.819	.387	
FINAL	.603	.448	.917	2.387	2.565	.844	.223	.229	.530		

TABLE 5. EXPERIMENT (G-18): DATE 280378

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	1102.3				85.5	1.08	2.20	6.58	50	2.6		
INIT	1031.2	907.4	123.8	44.0	79.8	1.05	2.08					
CTL	1021.1	863.6	157.5	69.3	88.2	1.07	2.09					
	616.1	537.3	78.8	11.6	67.2	1.04	1.66	5.62	50	1.5		
MICROZOO	698.4	567.1	131.3	40.7	90.6	0.96	1.66	6.28				
FINAL	651.3	568.8	82.5	9.9	72.6	0.96	1.61	7.27				
	664.8	548.5	116.3	23.0	93.3	1.04	1.70	6.98	120	1.8		
MACROZOO	654.7	545.9	108.8	15.5	93.3	1.06	1.71	6.10				
FINAL	612.7	492.7	120.0	26.7	93.3	1.02	1.63	6.83				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.154	.093	.087	.090	.119	.241	.488	.848	.882	.555		
CONTROL	.796	.457	.469	.547	.398	.153	.113	.040	.032			
MICROZOO	.117	.083	.074	.081	.109	.246	.540	.790	.655	.295		
FINAL	.861	.425	.463	.583	.478	.185	.140	.142	.121			
MACROZOO	.128	.093	.085	.090	.123	.269	.534	.764	.766	.432		
FINAL	.848	.439	.493	.554	.472	.193	.127	.133	.094			

TABLE 6. EXPERIMENT (G-19); DATE 100478

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	645.0	431.2	213.8	149.6	64.2	1.51	2.16	6.02	360		13.7	
INIT	617.8	402.1	215.7	128.1	87.6	1.52	2.14					
CTL	777.8	560.2	217.6	118.0	99.6	1.57	2.35					
	516.4	349.5	166.9	92.2	74.7	1.53	2.05	3.77	380		14.0	
MICROZOO	532.2	350.3	181.9	94.3	87.6	1.51	2.04	5.08				
FINAL	559.4	409.4	150.0	65.7	84.3	1.57	2.13	4.82				
	462.2	300.9	161.3	99.5	61.8	1.56	2.02	4.20	310		6.5	
MACROZOO	616.4	393.2	223.2	137.4	85.8	1.37	1.99	4.55				
FINAL	610.8	412.0	198.8	120.8	78.0	1.63	2.24	4.79				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.180	.122	.102	.125	.177	.298	.405	.493	.417	.224
CONTROL	.225	.258	.389	.586	.661	.292	.367	.149	.553	
MICROZOO	.169	.105	.085	.094	.151	.258	.344	.398	.327	.219
FINAL	.185	.207	.321	.485	.338	.169	.176	.126	.401	
MACROZOO	.173	.108	.090	.098	.155	.264	.340	.386	.323	.224
FINAL	.196	.203	.288	.393	.306	.146	.233	.145	.444	

TABLE 7. EXPERIMENT (G-20): DATE 190478

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	1291.6	1154.9	136.9	67.0	69.9	1.05	2.34	6.48	350	4.4		
INIT	1379.2	1232.9	146.3	94.1	52.2	1.03	2.41					
CTL	1376.2	1216.8	159.4	90.4	69.0	1.10	2.48					
	751.0	623.4	127.6	35.2	92.4	0.94	1.69	4.84	370	5.0		
MICROZOO	727.3	633.5	93.8	1.4	92.4	0.96	1.69	4.17				
FINAL	659.2	546.3	112.9	32.5	80.4	0.98	1.64	4.25				
	706.6	552.8	153.8	55.7	98.1	1.02	1.73	5.24	190	3.1		
MACROZOO	728.8	606.9	121.9	23.8	98.1	0.94	1.67	4.92				
FINAL	771.8	636.8	135.0	55.5	79.5	0.96	1.73	3.71				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
	.200	.117	.099	.112	.144	.242	.354	.332	.298	.346		
INITIAL CONTROL	.386	.476	.580	.622	.558	.323	.443	.225	.622			
	.164	.091	.072	.076	.112	.190	.223	.225	.201	.244		
MICROZOO FINAL	.297	.335	.382	.453	.321	.188	.241	.196	.412			
	.157	.089	.073	.074	.113	.191	.219	.220	.196	.197		
MACROZOO FINAL	.304	.340	.425	.452	.308	.168	.207	.273	.541			

TABLE 8. EXPERIMENT (G-21); DATE 030578

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	1049.3	844.9	204.4	108.1	96.3	1.01	2.06	5.83				
INIT	961.9	806.2	155.7	73.8	81.9	1.08	2.04					
CTL	985.6	801.8	183.8	80.9	102.9	1.08	2.07					
	710.1	471.9	238.2	181.2	57.0			3.29				
MICROZOO	791.5	587.1	204.4	152.2	52.2			4.81				
FINAL	756.0	617.2	138.8	56.0	82.8			3.66				
	412.3	267.9	144.4	72.1	72.3			4.20				
MACROZOO	476.0	309.1	166.9	85.0	81.9			4.56				
FINAL	489.3	358.0	131.3	47.9	83.4			3.65				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.180	.120	.102	.153	.210	.371	.443	.367	.305	.299		
CONTROL	.271	.346	.367	.436	.718	.350	.280	.164	.348			
MICROZOO	.099	.067	.063	.101	.199	.279	.263	.246	.194	.220		
FINAL	.262	.287	.347	.289	.325	.139	.159	.186	.193			
MACROZOO	.128	.085	.074	.119	.214	.291	.305	.292	.236	.224		
FINAL	.270	.290	.325	.287	.277	.114	.129	.099	.378			

TABLE 9. EXPERIMENT (G-22); DATE 170578

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	1233.6	791.0	442.6	320.5	122.1	1.53	2.76	9.66	10		27.4	
	1176.6	842.8	333.8	223.1	110.7	1.37	2.55	9.25				
CTL	1165.0	731.8	433.2	317.7	115.5	1.56	2.73					
MICROZOO	1010.8	632.0	378.8	266.3	112.5			7.22	10		18.5	
	1055.0	489.3	365.7	255.6	110.1			7.89				
FINAL	1056.6	694.7	361.9	247.0	114.9			8.26				
MACROZOO	1042.2	650.3	391.9	263.5	129.4			7.98	0		16.2	
	1129.4	733.7	395.7	281.7	114.0			8.44				
FINAL	1118.0	791.7	326.3	199.4	126.9			6.90				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.261	.234	.220	.292	.420	.659	1.157	1.243	.650	.199
CONTROL	.211	.269	.279	.818	1.572	.521	.241	.145	.067	
MICROZOO	.180	.149	.188	.297	.450	.676	1.264	.881	.434	.222
FINAL	.170	.225	.239	.627	1.280	.300	.124	.039	.046	
MACROZOO	.178	.148	.184	.295	.447	.660	1.246	.915	.426	.217
FINAL	.174	.215	.242	.641	1.169	.279	.143	.133	.062	

TABLE 10. EXPERIMENT (G-23); DATE 310578

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	826.3	509.4	316.9	288.1	28.8	1.47	2.30	5.87	80	31.5		
INIT	830.9	559.0	271.9	236.5	35.4	1.64	2.47					
CTL	815.4	532.2	283.2	243.9	39.3							
	604.6	342.0	262.6	228.1	34.5			4.49				
MICROZOO	652.6	416.3	236.3	208.1	28.2			4.95				
FINAL	699.2	417.9	281.3	246.8	34.5			3.96				
	671.2	442.4	228.8	196.7	32.1			4.71				
MACROZOO	693.0	421.1	271.9	231.7	40.2			4.67				
FINAL	618.5	412.2	206.3	170.9	35.4			3.93				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.337	.192	.159	.157	.144	.152	.182	.180	.092	.176
CONTROL	.242	.187	.269	.587	1.274	.675	.316	.392	.153	
MICROZOO	.280	.178	.167	.199	.237	.243	.197	.177	.150	.167
FINAL	.215	.143	.214	.369	.643	.262	.231	.229	.144	
MACROZOO	.286	.192	.177	.207	.249	.254	.202	.183	.134	.148
FINAL	.150	.117	.173	.428	.693	.232	.200	.256	.154	

TABLE 11. EXPERIMENT (G-24); DATE 120778

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	1109.5	680.1	429.4	318.7	110.7	1.16	2.27					
CTL	1153.9	645.7	508.2	406.2	102.0	1.14	2.29					
	1140.6	728.0	412.6	331.6	81.0	1.15	2.29					
MICROZOO	841.3	410.0	431.3	329.3	102.0	1.17	2.01					
FINAL	891.7	486.7	405.0	282.9	122.1	1.15	2.04					
	913.9	338.2	575.7	460.8	114.9	1.20	2.11					
MACROZOO	851.7	300.4	551.3	432.5	118.8	1.19	2.04					
FINAL	859.1	412.8	446.3	347.6	98.7	1.11	1.97					
	820.6	400.6	420.0	305.1	114.9	1.16	1.98					

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	

INITIAL CONTROL

MICROZOO FINAL

MACROZOO FINAL

TABLE 12. EXPERIMENT (G-25); DATE 180778

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	935.6	704.6	231.0	173.1	57.9	1.32	2.26	7.02	120		9.5	
CTL	1012.8	743.5	269.3	203.6	65.7	1.29	2.30					
	908.4	761.4	147.0	99.6	47.4	1.48	2.39					
MICROZOO	735.6	435.5	300.1	233.5	66.6	1.26	2.00	5.80	160		15.7	
FINAL	761.4	498.1	263.3	213.5	49.8	1.32	2.08	5.93				
	775.6	477.8	297.8	233.6	64.2	1.25	2.03	5.89				
MACROZOO	720.0	480.0	240.0	166.2	73.8	1.25	1.97	4.58	100		10.1	
FINAL	811.4	422.1	389.3	319.4	69.9	1.26	2.07	6.04				
	835.6	429.8	405.8	317.6	88.2	1.28	2.12	6.09				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.192	.171	.195	.329	.480	.590	.770	.442	.366	.348
CONTROL	.339	.282	.361	.962	.495	.307	.223	.085	.085	
MICROZOO	.154	.150	.161	.368	.490	.514	.629	.331	.345	.315
FINAL	.328	.255	.404	.806	.253	.124	.099	.098	.052	
MACROZOO	.166	.162	.178	.386	.513	.532	.633	.325	.326	.311
FINAL	.352	.281	.260	.517	.287	.169	.099	.061	.013	

TABLE 13. EXPERIMENT (G-26): DATE 020878

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	1070.5	704.8	365.7	221.1	144.6	1.16	2.23	10.04				
CTL	1049.7	678.4	371.3	226.7	144.6	1.21	2.26					
	1227.5	860.0	367.5	231.0	136.5	1.21	2.44					
MICROZOO	900.1	596.3	303.8	220.4	83.4			8.01				
	971.2				94.8							
FINAL	892.7	596.4	296.3	232.1	64.2			8.13				
	971.2				92.4			7.62				
MACROZOO	978.6	614.8	363.8	270.8	93.0			6.28				
FINAL	991.9	661.9	330.0	237.6	92.4			7.28				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0	
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0		
INITIAL CONTROL	.362	.252	.167	.270	.373	.729	1.893	1.276	.460	.249	
	.392	.279	.328	.505	.503	.571	.525	.616	.290		
MICROZOO FINAL	.340	.231	.167	.272	.434	.915	1.257	.538	.325	.209	
	.227	.210	.270	.373	.406	.516	.556	.367	.457		
MACROZOO FINAL	.347	.241	.174	.284	.447	.973	1.354	.610	.360	.228	
	.240	.162	.158	.219	.230	.237	.360	.204	.233		

TABLE 14. EXPERIMENT (G-27); DATE 160878

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
			367.6	328.3	39.3	1.41		5.97	60	49.9		
INIT	374.0		316.9	285.7	31.2	1.39	1.76				61.2	6.1
CTL	380.8		360.0	325.5	34.5	1.45	1.83				58.0	6.6
	291.2		348.8	299.9	48.9	1.51	1.80	5.22	60	24.9	54.2	5.4
MICROZOO	299.8		341.3	282.8	58.5			5.65			59.0	5.1
FINAL	327.6		384.4	340.9	43.5	1.41	1.74	5.06			58.4	5.6
	331.2		369.4	310.0	59.4	1.41	1.74	5.98	90	14.0	70.2	4.7
MACROZOO	350.0		371.3	305.6	65.7	1.43	1.78	5.07			60.2	5.8
FINAL	334.4		380.7	309.9	70.8	1.44	1.77	5.36			62.8	5.3

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.177	.214	.391	.688	.479	.360	.422	.362	.345	.228
CONTROL	.325	.310	.544	.397	.299	.114	.110	.069	.136	
MICROZOO	.190	.210	.448	.628	.406	.491	.446	.323	.214	.170
FINAL	.282	.312	.547	.249	.181	.060	.034	.037	.084	
MACROZOO	.197	.225	.465	.638	.433	.514	.470	.359	.234	.136
FINAL	.260	.290	.491	.225	.181	.076	.118	.096	.060	

TABLE 15. EXPERIMENT (G-28)1 DATE 300878

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	361.8		373.2	315.3	57.9	1.01	1.37	4.08			44.4	8.1
	339.8				66.6	1.00	1.34				46.6	7.3
CTL	350.0		393.8	328.1	65.7	1.07	1.42				45.0	7.8
MICROZOO	275.4		300.1	239.2	60.9			4.17			41.6	6.6
FINAL	298.2		268.2	219.9	48.3			4.13			38.8	7.7
	387.4		335.7	261.1	54.6			4.52			52.2	7.4
MACROZOO	270.0		296.3	233.0	63.3			4.08			38.8	7.0
FINAL	329.2		292.5	230.7	61.8			4.03			41.6	7.9
	307.8		300.0	236.7	63.3			4.14			43.8	7.3

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL CONTROL	.152	.119	.203	.294	.261	.254	.240	.138	.108	.124
	.197	.156	.166	.482	.737	.116	.069	.108	.154	
MICROZOO FINAL	.139	.103	.156	.253	.273	.231	.182	.100	.078	.102
	.156	.322	.266	.675	.700	.119	.129	.105	.184	
MACROZOO FINAL	.143	.106	.173	.245	.252	.208	.178	.105	.091	.115
	.153	.232	.224	.602	.783	.123	.171	.097	.085	

TABLE 16. EXPERIMENT (G-29); DATE 130978

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	900.2		412.5	227.7	184.8	1.40	2.30	12.70	130	7.1	109.0	8.3
INIT	779.0		562.5	357.6	204.9	1.30	2.08				88.4	8.8
CTL	724.4		562.5	345.6	216.9	1.31	2.03				88.0	8.2
	306.6		337.5	213.0	124.5	1.64	1.95	4.61	140	6.0	38.0	8.1
MICROZOO	356.6		356.3	207.8	148.5	1.60	1.96	5.05			44.1	8.1
FINAL	367.8		356.3	231.9	124.5	1.40	1.77	4.51			45.2	8.1
	433.0		375.0	246.6	128.4	1.57	2.00	4.99	120	3.8	51.6	8.4
MACROZOO	482.0		525.0	344.4	180.6	1.60	2.08	5.36			59.2	8.1
FINAL	467.6		356.3	211.7	144.6	1.37	1.84	5.46			60.8	7.7

AVERAGE COULTER	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
COUNTS(PPM)	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.100	.095	.190	.196	.145	.159	.232	.125	.090	.160
CONTROL	.145	.137	.172	3.492	6.522	.580	.061	.061	.044	
MICROZOO	.115	.100	.176	.177	.182	.187	.218	.098	.060	.087
FINAL	.098	.131	.127	1.239	1.462	.082	.017	.043	.124	
MACROZOO	.139	.110	.191	.190	.181	.186	.206	.093	.063	.081
FINAL	.086	.112	.139	1.289	1.953	.125	.038	.051	.039	

TABLE 17. EXPERIMENT (G-30); DATE 270978

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	466.7	399.2	67.5	22.5	45.0	1.04	1.51	4.31				
INIT	479.1	400.3	78.8	29.0	49.8	1.01	1.49					
CTL	541.1	387.3	153.8	107.3	46.5	1.01	1.55					
	401.6	268.4	133.2	89.7	43.5			3.47				
MICROZOO	435.7	313.8	121.9	85.0	36.9			2.77				
FINAL	448.1	311.2	136.9	92.8	44.1			2.98				
	400.0				41.1			3.05				
MACROZOO	457.4	301.7	155.7	106.8	48.9			4.39				
FINAL	392.3	259.1	133.2	87.3	45.9			2.64				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.103	.120	.183	.171	.238	.309	.431	.307	.163	.282		
CONTROL	.497	.226	.214	.302	.283	.175	.062	.062	.185			
MICROZOO	.099	.099	.129	.128	.161	.184	.228	.131	.114	.188		
FINAL	.203	.213	.297	.316	.141	.098	.102	.088	.158			
MACROZOO	.105	.102	.141	.132	.176	.207	.250	.151	.126	.225		
FINAL	.248	.206	.279	.275	.163	.146	.144	.103	.184			

TABLE 18. EXPERIMENT (G-31); DATE 111078

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	741.2		510.0	369.6	140.4	1.04	1.78	9.48	210	2.7	77.8	9.5
INTT	718.8		515.7	359.1	156.6	1.09	1.81				78.6	9.1
CTL			450.1	313.6	136.5	1.05						
	547.6		320.7	168.0	152.7	1.13	1.68	6.33	300	1.6	67.8	9.1
MICROZOO	577.6		406.9	258.4	148.5	1.22	1.80	5.94			74.6	7.7
FINAL	595.6		367.6	178.9	188.7	1.09	1.69	6.98			70.4	8.5
	524.2		378.8	286.4	92.4	1.31	1.83	5.80	250	1.8	71.2	7.4
MACROZOO	599.4		266.3	121.7	144.6	1.35	1.95	5.93			76.0	7.9
FINAL	590.4		262.6	139.6	123.0	1.05	1.64	5.39			72.8	8.1

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.078	.056	.073	.069	.068	.079	.139	.040	.040	.054
CONTROL	.102	.134	.370	2.184	4.382	.957	.211	.214	.233	
MICROZOO	.091	.057	.074	.089	.096	.107	.147	.099	.058	.069
FINAL	.083	.104	.215	1.560	2.827	.387	.123	.091	.135	
MACROZOO	.094	.055	.073	.084	.085	.096	.127	.066	.049	.057
FINAL	.076	.110	.205	1.441	2.437	.377	.105	.071	.102	

TABLE 19. EXPERIMENT (G-32); DATE 251078

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META PROTO PON C/N
	758.1	484.3	273.8	158.9	114.9	1.00	1.76	5.03	
INIT	775.1	420.7	354.4	241.3	113.1	1.00	1.78	5.10	
CTL	710.8	472.6	238.2	138.6	99.6	1.02	1.73		
	609.2	408.5	200.7	102.0	98.7			5.41	
MICROZOO	658.8	345.6	313.2	200.1	113.1			4.02	
FINAL	668.1	306.2	361.9	245.5	116.4			6.28	
	750.3	461.5	288.8	173.3	115.5			4.17	
MACROZOO	676.0	484.7	191.3	86.9	104.4			5.63	
FINAL			253.2	108.6	144.6			6.55	

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.085	.072	.116	.156	.155	.245	.494	.434	.193	.176
CONTROL	.216	.117	.255	.465	1.261	.326	.109	.129	.059	
MICROZOO	.090	.062	.098	.117	.127	.220	.423	.214	.141	.119
FINAL	.149	.136	.330	.669	1.122	.328	.228	.189	.473	
MACROZOO	.099	.070	.110	.121	.131	.201	.344	.150	.099	.119
FINAL	.168	.165	.391	.737	1.532	.377	.173	.272	.190	

TABLE 20. EXPERIMENT (G-33); DATE 081178

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	1616.9				112.5	0.98	2.60	6.94	180		28.6	
INIT	1509.3	974.9	534.4	417.1	117.3	0.98	2.49	8.91				
CTL	1396.7	854.8	541.9	424.6	117.3	1.03	2.43					
	1055.5	695.5	360.0	248.4	111.6			6.54	110		29.0	
MICROZOO	924.5	572.0	352.5	248.1	104.4			4.74				
FINAL	1393.4	1095.2	298.2	181.8	116.4			8.56				
	1435.4	966.6	468.8	345.8	123.0			8.06	150		17.6	
MACROZOO	1237.1	850.8	386.3	292.4	93.9			6.61				
FINAL	840.4	555.4	285.0	197.4	87.6			4.93				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.116	.071	.096	.148	.179	.176	.233	.243	.104	.126
CONTROL	.133	.128	1.323	2.822	1.261	.433	.134	.085	.112	
MICROZOO	.121	.083	.101	.150	.166	.162	.210	.135	.090	.101
FINAL	.189	.276	1.379	2.093	.811	.274	.143	.039	.095	
MACROZOO	.149	.093	.103	.141	.156	.146	.192	.115	.065	.075
FINAL	.157	.237	1.303	2.281	.831	.226	.136	.084	.046	

TABLE 21. EXPERIMENT (G-34); DATE 221178

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
	647.8	374.0	273.8	171.5	102.3	1.15	1.80	5.28				
INIT	642.0	285.7	356.3	249.8	106.5	1.11	1.75	6.51				
CTL	616.6	352.2	264.4	170.2	94.2	1.08	1.70					
	324.4	204.4	120.0	89.1	30.9	1.04	1.36	2.19				
MICROZOO	408.0	276.7	131.3	92.9	38.4	1.11	1.52	2.99				
FINAL	674.6	440.2	234.4	177.1	57.3	1.10	1.78	4.63				
	862.0	597.6	264.4	203.8	60.6	1.09	1.95	5.66				
MACROZOO	846.4	668.2	178.2	116.4	61.8	1.14	1.99	4.87				
FINAL	562.6	408.8	153.8	103.7	50.1	1.12	1.68	3.71				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.063	.046	.048	.066	.091	.110	.132	.132	.086	.108		
CONTROL	.150	.131	.678	1.595	1.508	.424	.221	.136	.177			
MICROZOO	.084	.043	.047	.064	.095	.094	.097	.076	.056	.093		
FINAL	.117	.130	.449	.757	.570	.165	.131	.093	.107			
MACROZOO	.100	.050	.056	.075	.103	.101	.107	.090	.063	.098		
FINAL	.142	.169	.637	1.279	.943	.224	.204	.136	.169			

TABLE 22. EXPERTMENT (G-351; DATE 061279

TRMT	POC	NOC	TOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	198.5	166.2	32.3	19.7	12.6	1.05	1.25	1.39	30	7.0		
CTL	185.9	144.6	41.3	25.1	16.2	1.13	1.32	1.70				
	183.4	149.6	33.8	18.8	15.0	1.10	1.28					
MICROZOO	149.8	113.8	36.0	26.1	9.9			1.67	10	3.8		
FINAL	139.7	116.4	23.3	15.5	7.8			1.10				
	161.6	136.1	25.5	15.6	9.9			1.35				
MACROZOO	180.1	145.6	34.5	28.5	6.0			1.30	10	1.6		
FINAL	189.3	159.3	30.0	22.5	7.5			1.15				
	177.5	144.5	33.0	26.7	6.3			1.33				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0	
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0		
INITIAL	.076	.071	.074	.091	.110	.109	.110	.082	.066	.051	
CONTROL	.069	.076	.076	.074	.098	.109	.090	.072	.042		
MICROZOO	.097	.067	.063	.076	.092	.071	.082	.055	.049	.056	
FINAL	.061	.076	.059	.061	.063	.068	.052	.028	.196		
MACROZOO	.104	.069	.069	.087	.093	.076	.083	.061	.049	.049	
FINAL	.073	.075	.059	.055	.060	.045	.064	.078	.014		

TABLE 23. EXPERIMENT (G-36): DATE 201278

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	207.6				19.8			1.89				
CTL	209.2	182.5	26.7	6.9	19.8	1.03	1.24	2.12				
	246.2	208.6	37.6	18.7	18.9	1.03	1.28					
MICROZOO	192.4	165.0	27.4	11.2	16.2			1.18				
FINAL	170.6	141.3	29.3	14.9	14.4			1.20				
	189.9	159.5	30.4	14.2	16.2			1.05				
MACROZOO	200.0	177.1	22.9	9.1	13.8			1.58				
FINAL	188.2	160.0	28.2	15.0	13.2			1.15				
	220.2	190.5	29.7	13.5	16.2			1.38				

AVERAGE COULTER COUNTS (PPM)										
	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL CONTROL	.071	.067	.071	.081	.082	.098	.122	.102	.071	.056
	.084	.088	.091	.109	.162	.219	.107	.148	.179	
MICROZOO FINAL	.069	.055	.055	.061	.056	.053	.061	.054	.035	.036
	.047	.046	.044	.084	.145	.064	.049	.072	.059	
MACROZOO FINAL	.079	.062	.064	.070	.066	.071	.075	.074	.047	.037
	.047	.045	.045	.084	.125	.087	.082	.096	.114	

TABLE 24. EXPERIMENT (G-37); DATE 030179

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	229.3	206.0	23.3	4.4	15.6	1.21	1.44	2.23	80	5.5		
CTL	221.5	201.6	19.9	4.9	17.7	1.17	1.39	2.02				
	240.0	217.4	22.6	4.3	18.9	1.28	1.52					
MICROZOO	206.6	181.1	25.5	8.1	17.4	1.18	1.39	1.71	80	5.7		
FINAL	225.8	207.4	18.4	4.6	13.8	1.33	1.56	1.71				
	223.7	203.0	20.7	4.5	16.2	1.26	1.48	1.71				
MACROZOO	209.5	191.5	18.0	4.2	13.8	1.31	1.52	1.59	00	2.2		
FINAL	196.0	179.8	16.2	4.5	11.7	1.26	1.46	2.05				
	208.1	188.9	19.2	6.0	13.2	1.34	1.55	2.01				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.148	.139	.151	.179	.194	.186	.192	.136	.109	.093		
CONTROL	.106	.089	.064	.079	.111	.062	.027	.046	.015			
MICROZOO	.143	.124	.122	.134	.137	.119	.113	.072	.065	.050		
FINAL	.064	.057	.043	.058	.131	.124	.042	.015	.101			
MACROZOO	.145	.128	.129	.141	.149	.140	.134	.105	.086	.073		
FINAL	.079	.066	.051	.059	.085	.068	.050	.048	.148			

TABLE 25. EXPERIMENT (G-38); DATE 170179

TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	174.6	139.7	34.9	12.7	22.2	0.96	1.13	2.37				
CTL	209.8	180.1	29.7	10.5	19.2	1.01	1.22	1.40				
	207.3	174.2	33.1	18.7	14.4	1.07	1.28					
MICROZOO	172.9	140.6	32.3	20.3	12.0			1.41				
FINAL	141.8	115.5	26.3	18.5	7.8			2.03				
	177.1	138.1	39.0	27.0	12.0			1.57				
MACROZOO	156.9	130.6	26.3	19.1	7.2			1.44				
FINAL	181.3	155.8	25.5	14.4	11.1			1.33				
	191.4	165.1	26.3	15.2	11.1			1.63				

AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0	
INITIAL	.058	.046	.046	.059	.070	.071	.083	.070	.065	.052
CONTROL	.101	.100	.084	.129	.176	.128	.180	.229	.139	
MICROZOO	.068	.050	.047	.056	.062	.053	.053	.035	.028	.028
FINAL	.041	.041	.037	.082	.161	.197	.129	.205	.297	
MACROZOO	.074	.052	.049	.059	.065	.063	.059	.044	.031	.032
FINAL	.041	.039	.032	.076	.115	.145	.132	.141	.213	

TABLE 26. EXPERIMENT (G-39): DATE 310179

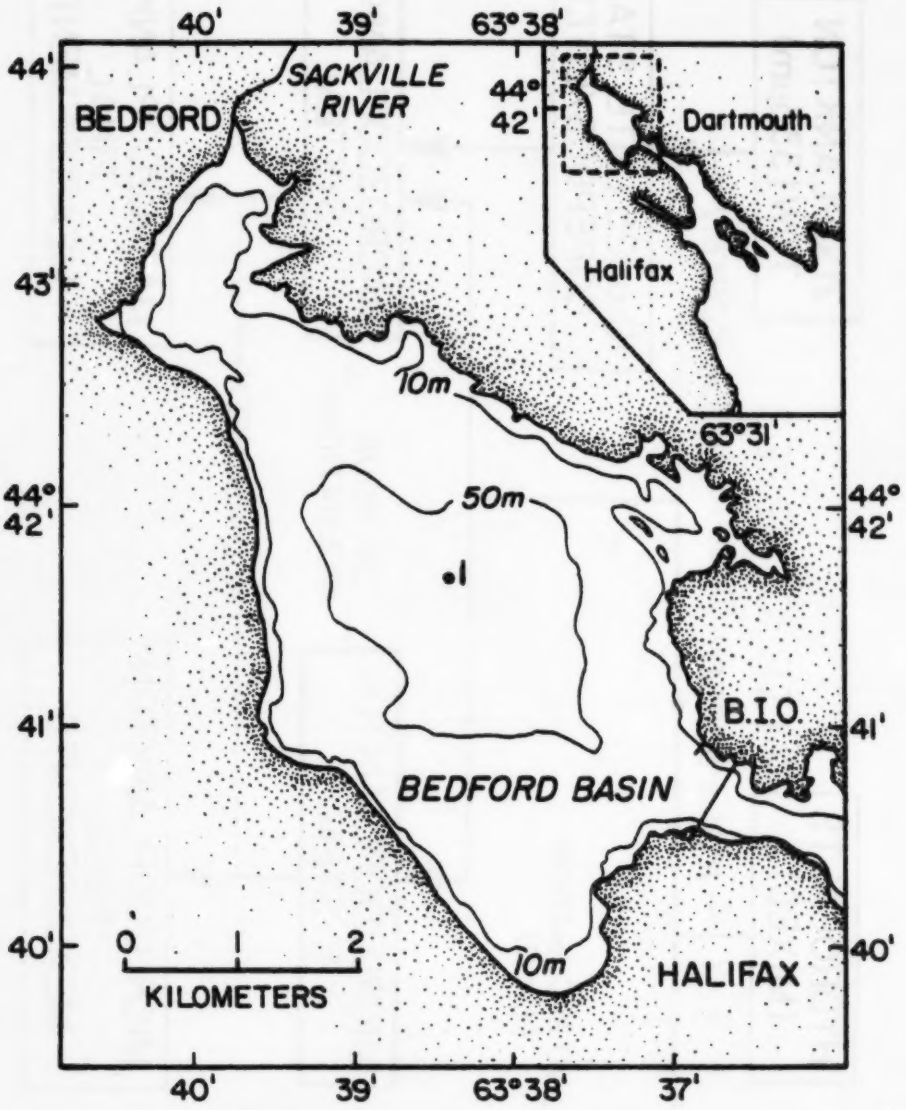
TRMT	POC	NOC	LOC	HPC	PPC	DOC	TOC	PPM	META	PROTO	PON	C/N
INIT	383.7	323.6	60.1	40.3	19.8	1.58	1.96	2.82	50	5.4		
CTL	312.1	273.4	38.7	20.7	18.0	1.55	1.86	3.15				
	291.5	262.6	28.9	13.9	15.0	1.49	1.78					
MICROZOO	271.0	231.6	39.4	25.3	14.1	1.60	1.87	1.83	70	3.9		
FINAL	251.8	227.0	24.8	11.9	12.9	1.58	1.83	1.95				
	272.4	238.6	33.8	18.5	15.3	1.43	1.70	1.79				
MACROZOO	255.4	232.1	23.3	13.7	9.6	1.59	1.85	1.63	30	1.7		
FINAL	263.9	245.8	18.1	10.6	7.5	1.49	1.75	1.53				
	290.1	263.8	26.3	15.2	11.1	1.59	1.88	1.66				
AVERAGE COULTER COUNTS(PPM)	2.00	2.52	3.17	4.00	5.04	6.35	8.00	10.1	12.7	16.0		
	20.2	25.4	32.0	40.3	50.8	64.0	80.6	102.0	128.0			
INITIAL	.144	.140	.154	.167	.175	.151	.145	.091	.068			
CONTROL	.078	.077	.066	.114	.186	.127	.131	.289	.622	.063		
MICROZOO	.167	.140	.148	.156	.157	.134	.109	.069	.043			
FINAL	.051	.064	.049	.079	.182	.133	.037	.055	.050	.033		
MACROZOO	.159	.140	.151	.161	.168	.142	.117	.072	.053			
FINAL	.054	.052	.038	.055	.070	.034	.021	.027	.046	.048		

FIGURE LEGENDS

Figure 1. Sampling site, station 1, in Bedford Basin.

Figure 2. Flow chart of experimental design.

Figures 3-27. Initial size distributions of particulate material. Particle concentrations are given as PPM (mm^3/l) for 19 Coulter size classes fom 2-128 µm (see Tables 1-26).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RIVER
BEDFORD
44°
42'
Dartmouth
Halifax
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10m
63°31'
44°
42'
50m
1
44°
42'
41'
B.I.O.
41'
BEDFORD BASIN
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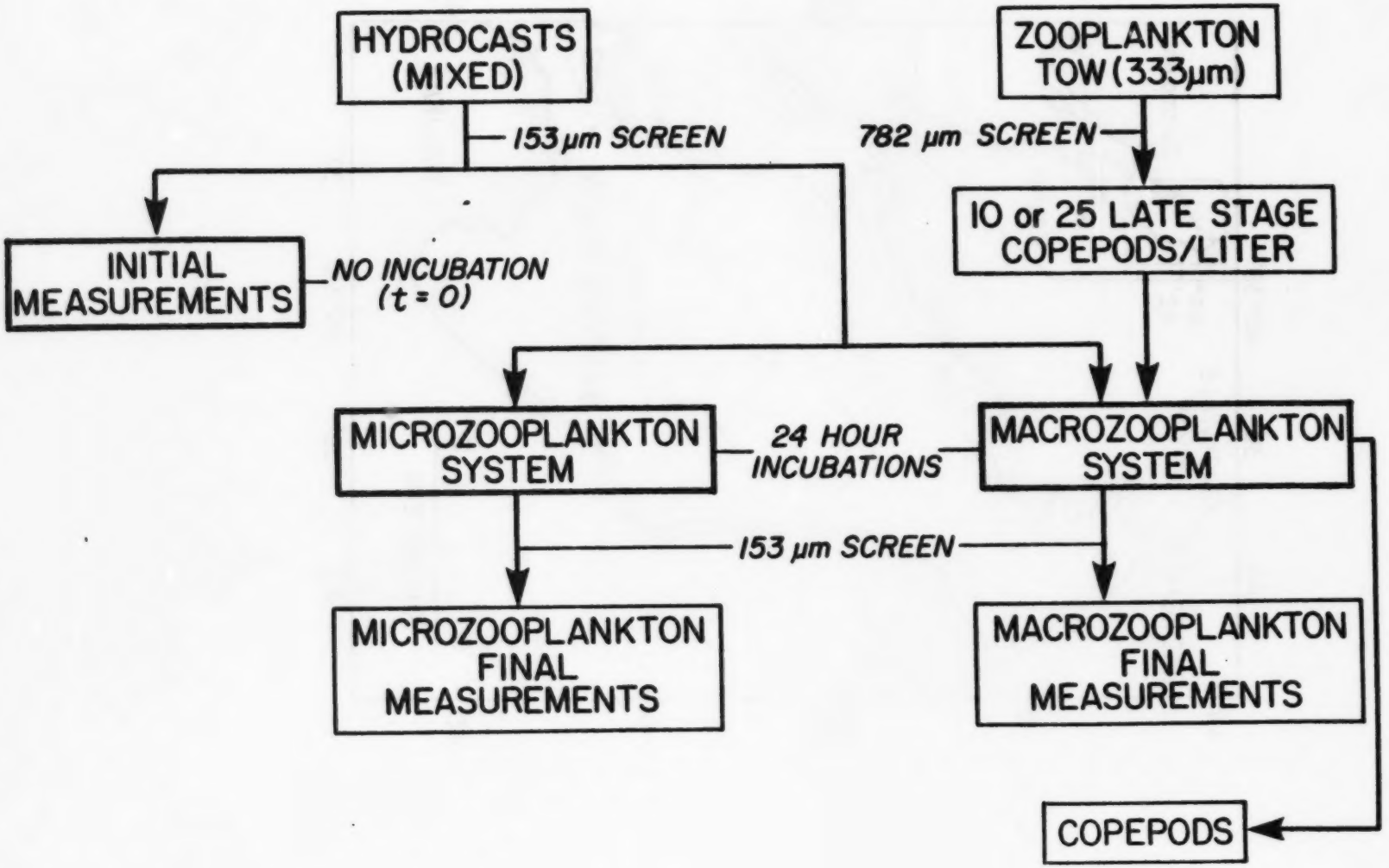
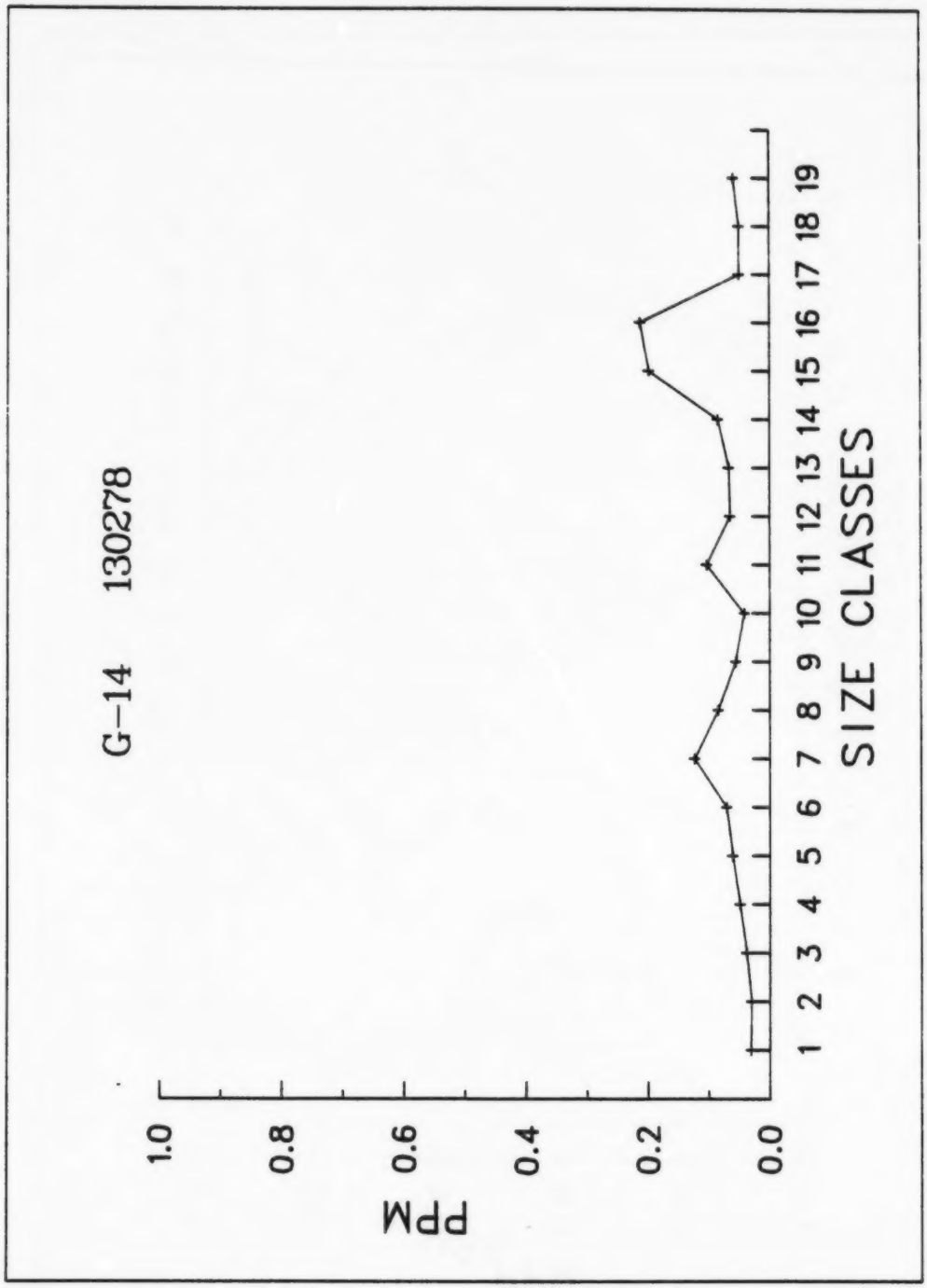
0
1
2
KILOMETERS
10m
HALIFAX
40'
40'
39'
63°38'
37'


HYDROCASTS (MIXED)
ZOOPLANKTON TOW (333µm)
153 µm SCREEN
782 µm SCREEN
INITIAL MEASUREMENTS
NO INCUBATION (t = 0)
10 or 25 LATE STAGE COPEPODS/LITER
MICROZOOPLANKTON SYSTEM
24 HOUR INCUBATIONS
MACROZOOPLANKTON SYSTEM
153 µm SCREEN
MICROZOOPLANKTON FINAL MEASUREMENTS
MACROZOOPLANKTON FINAL MEASUREMENTS
COPEPODS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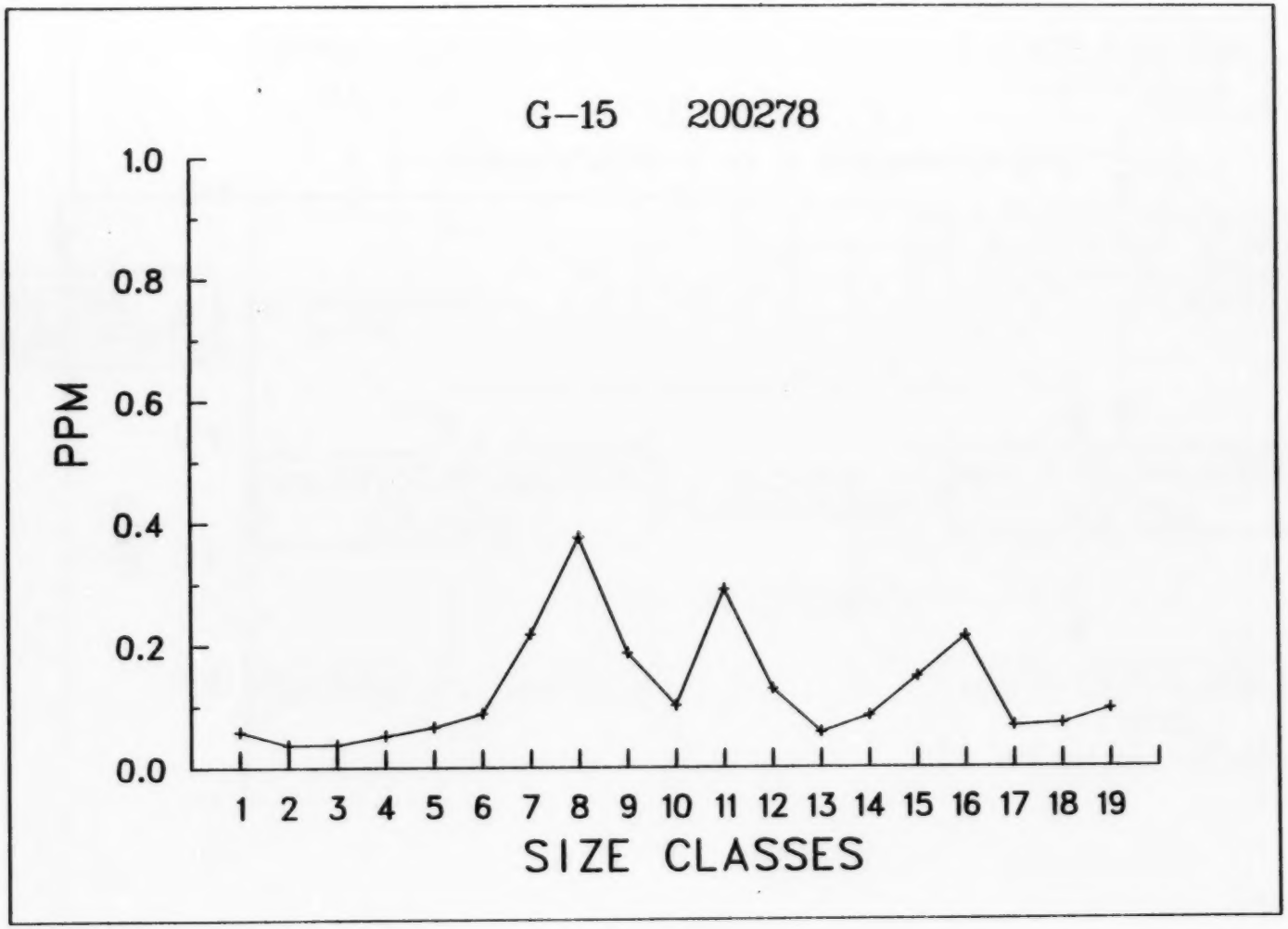
SIZE CLASSES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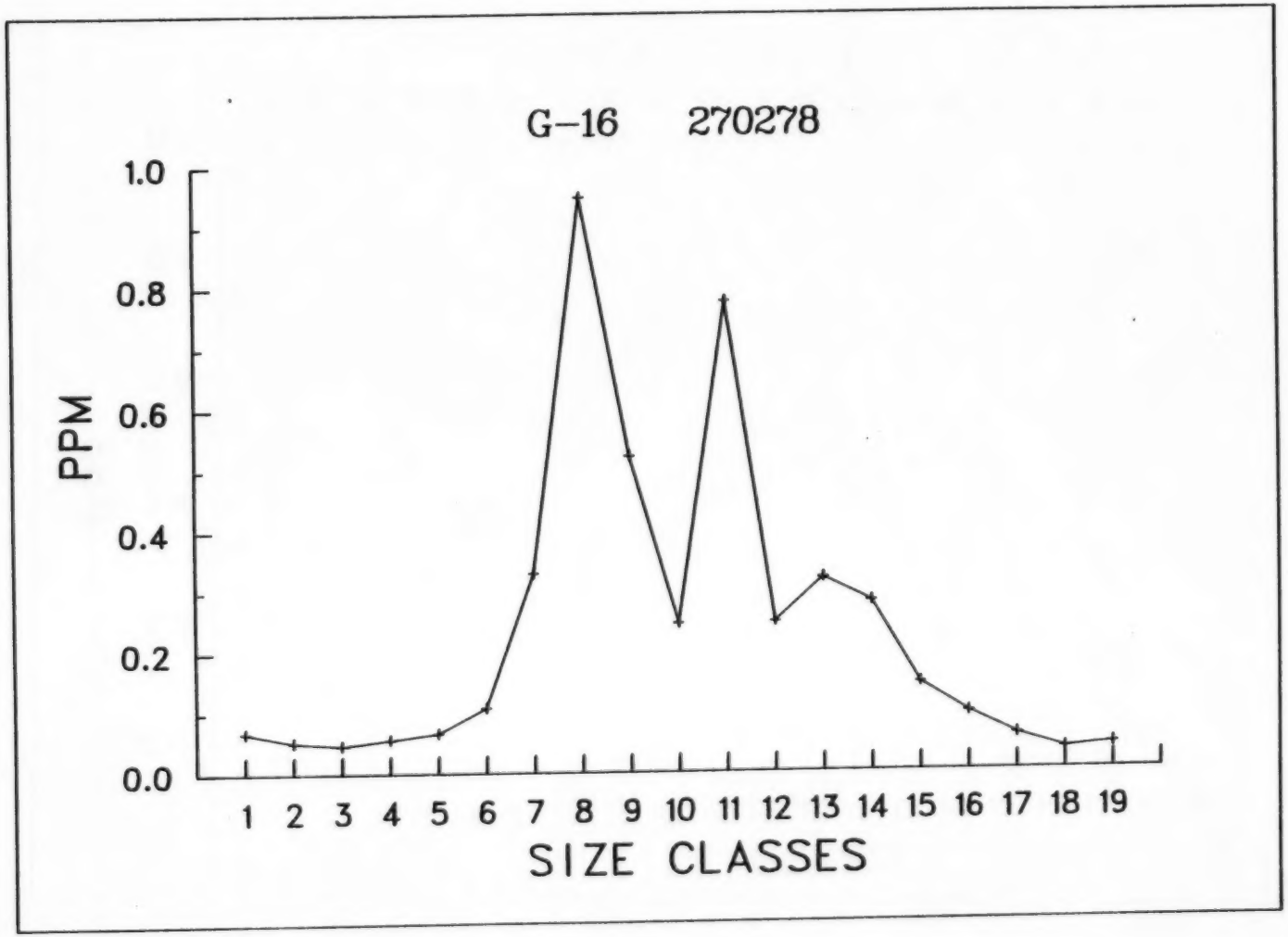
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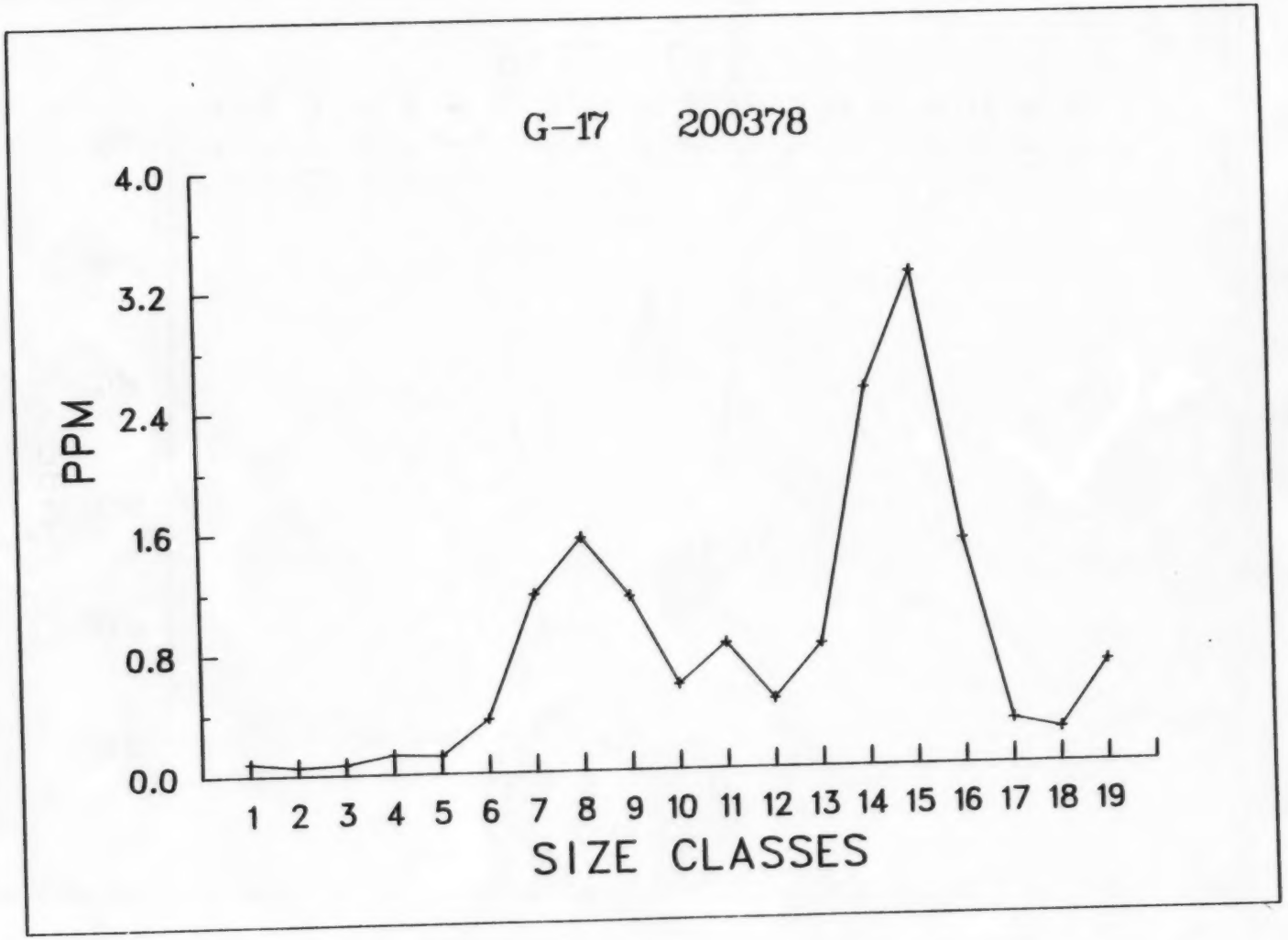
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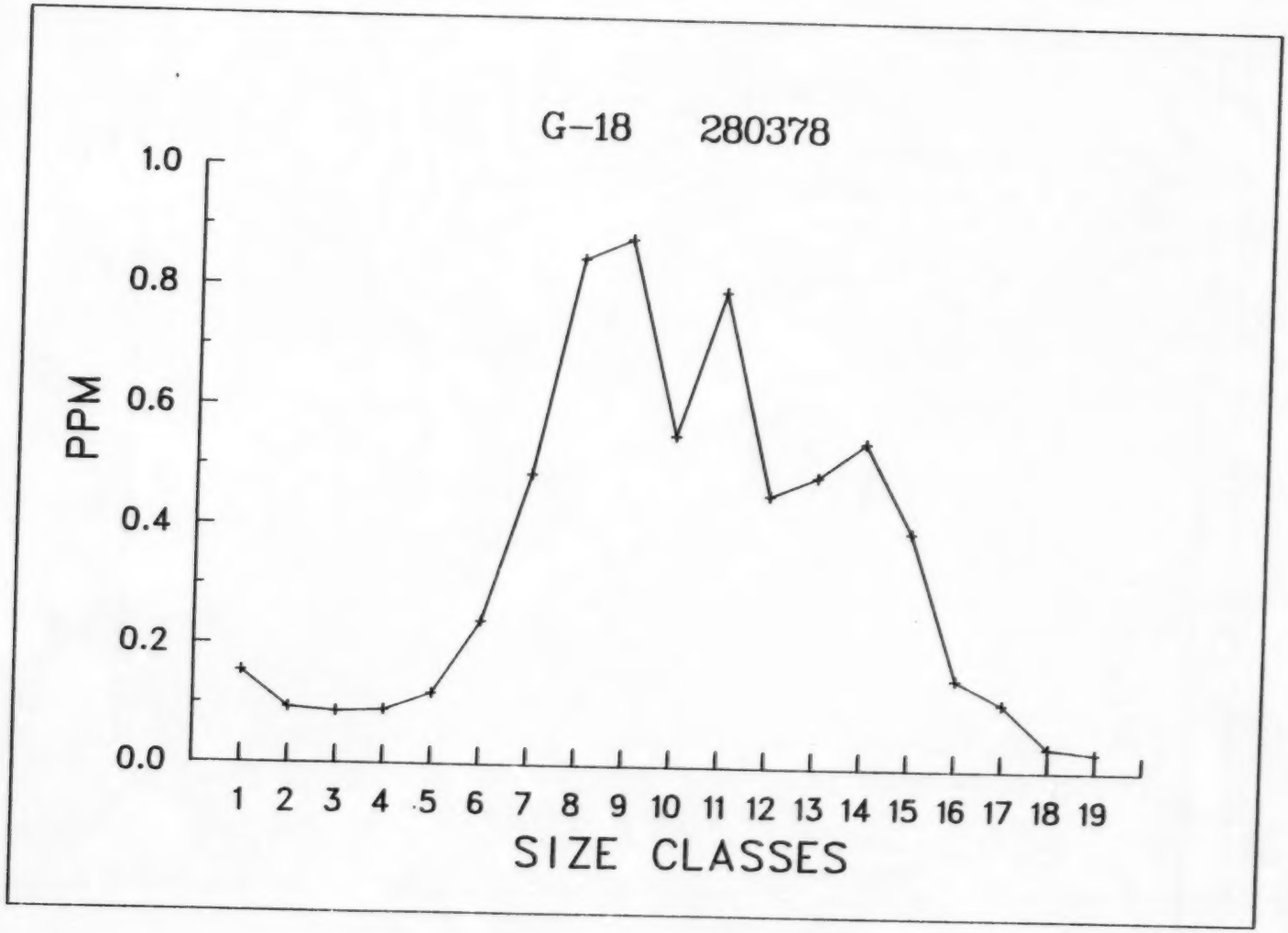
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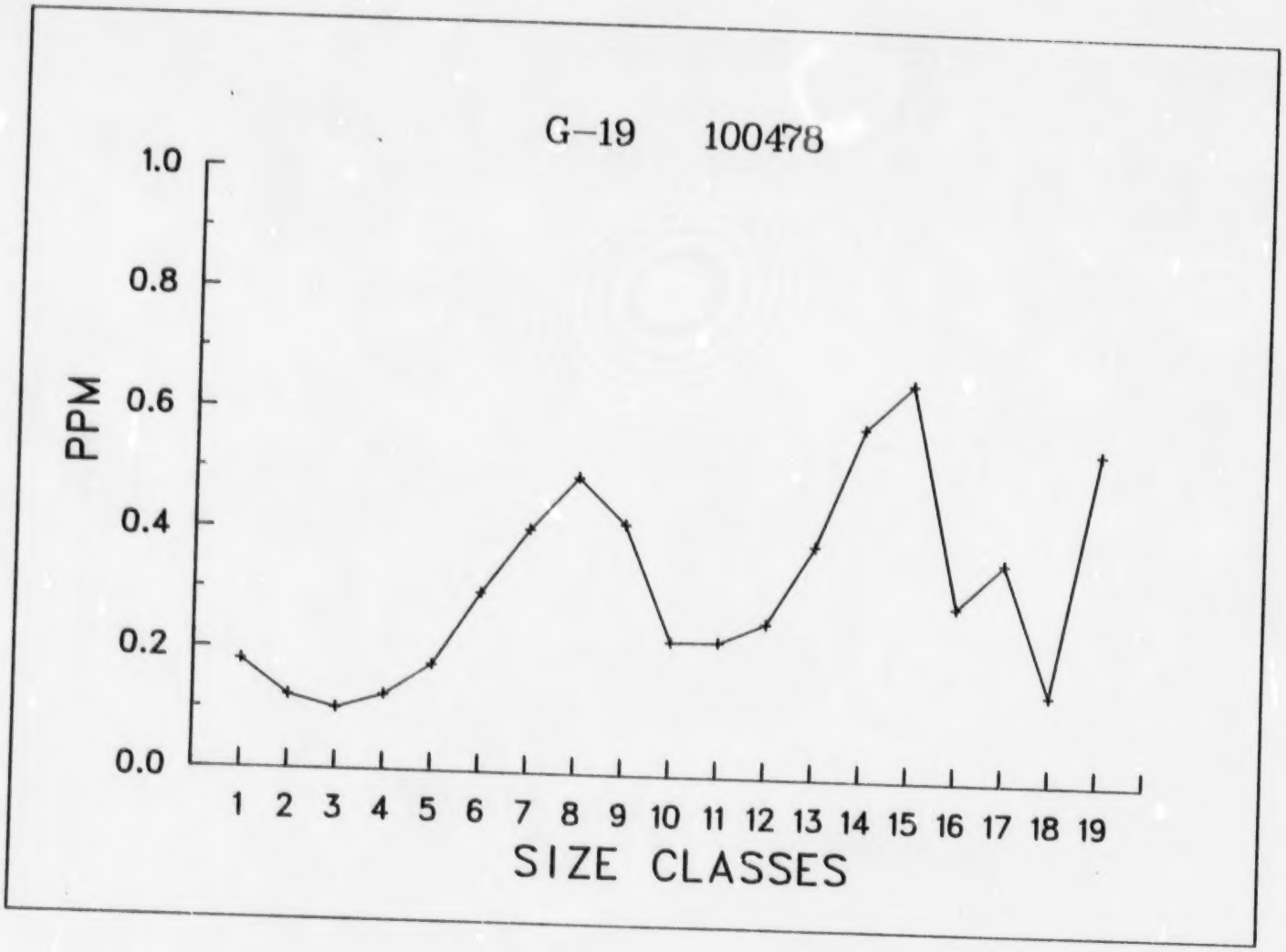
SIZE CLASSES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PPM
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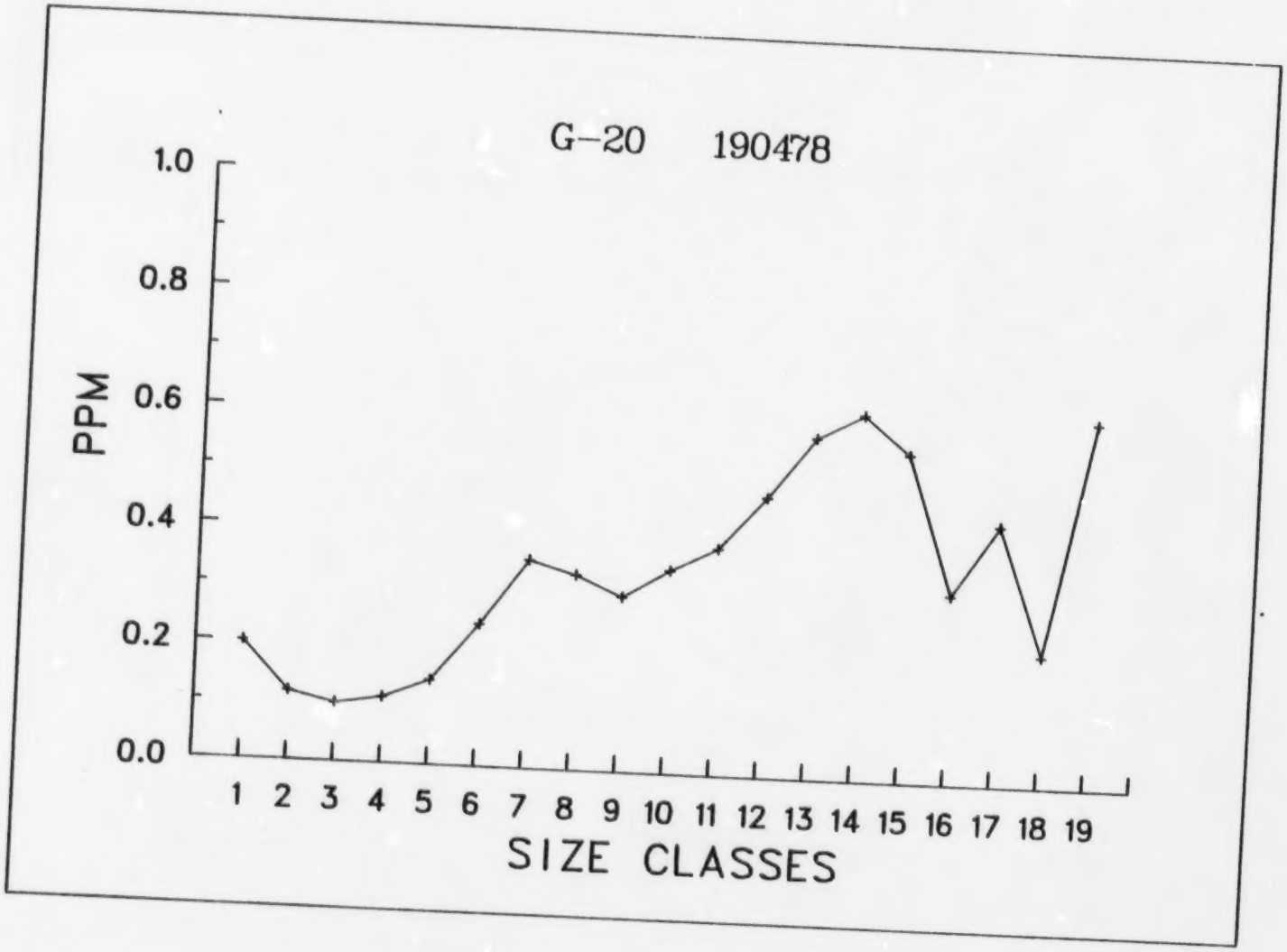
SIZE CLASSES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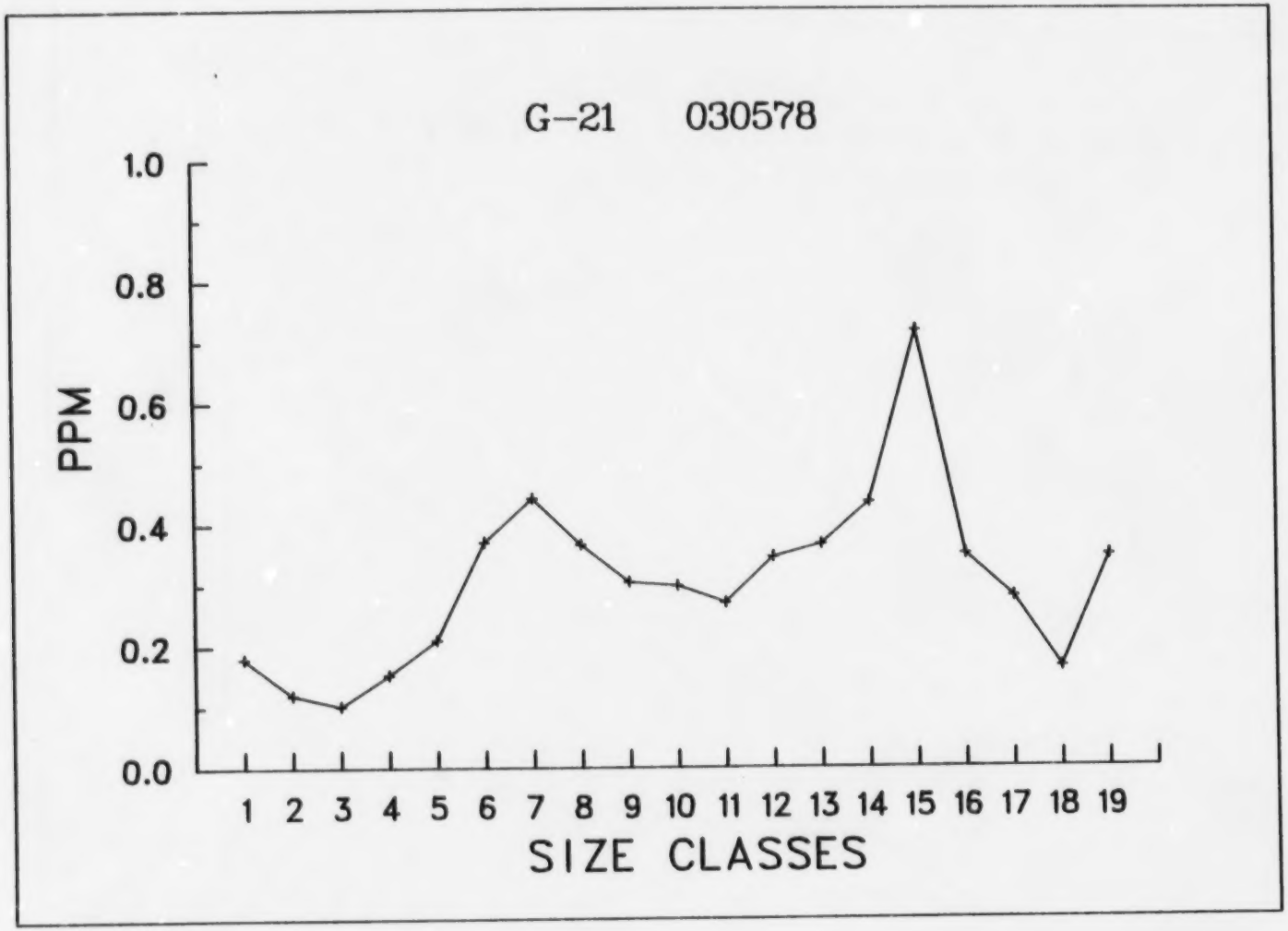
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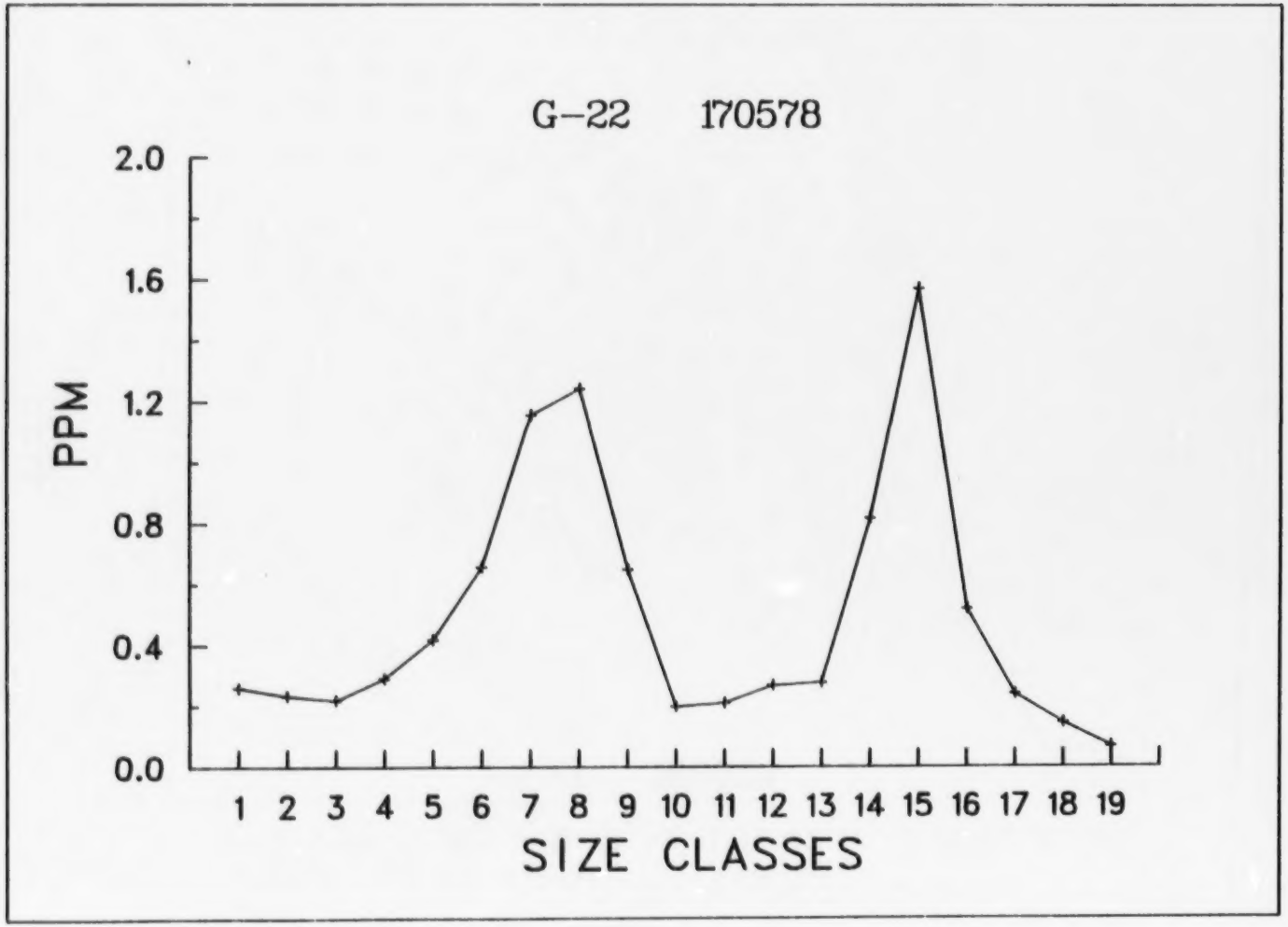
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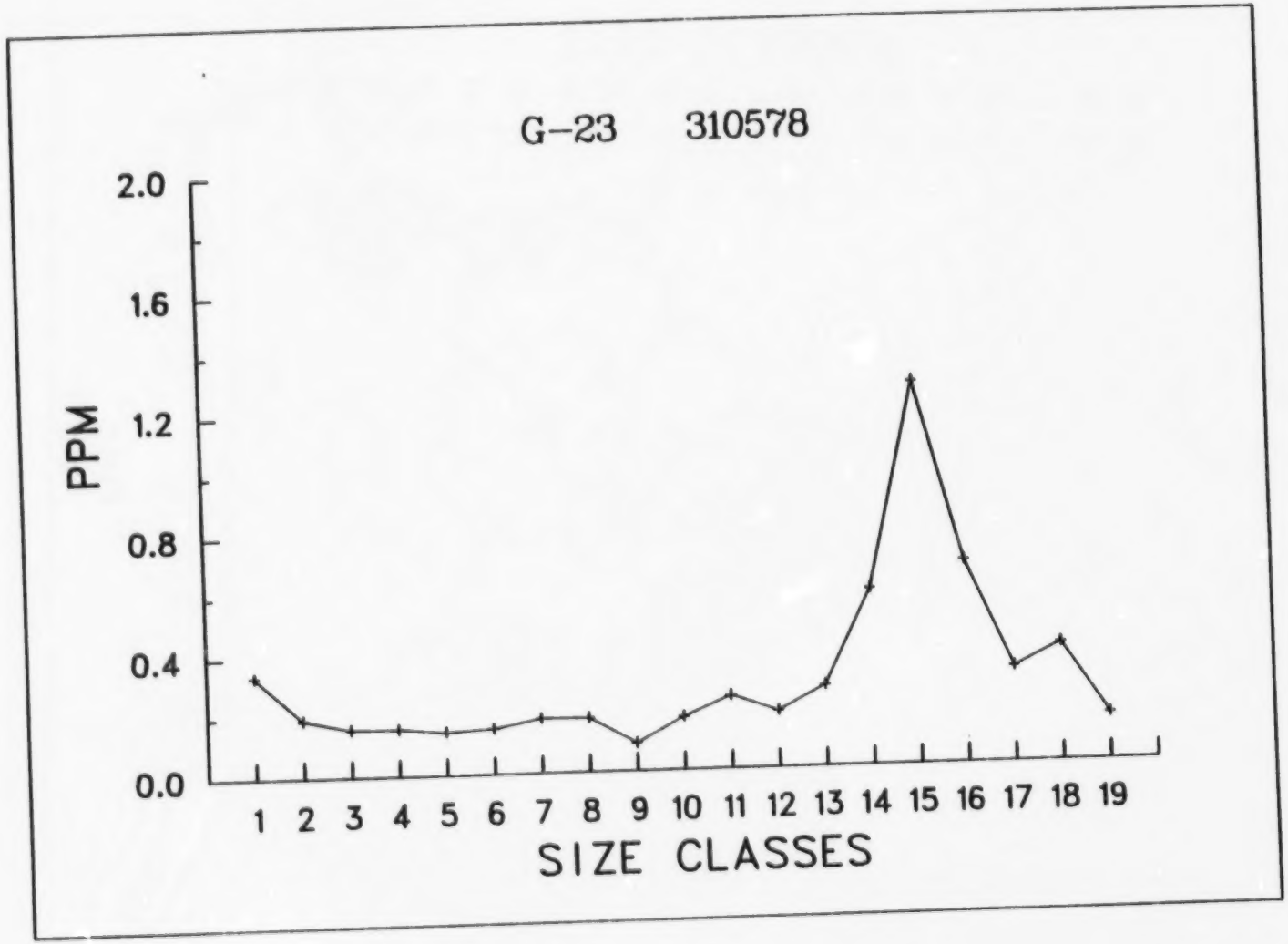
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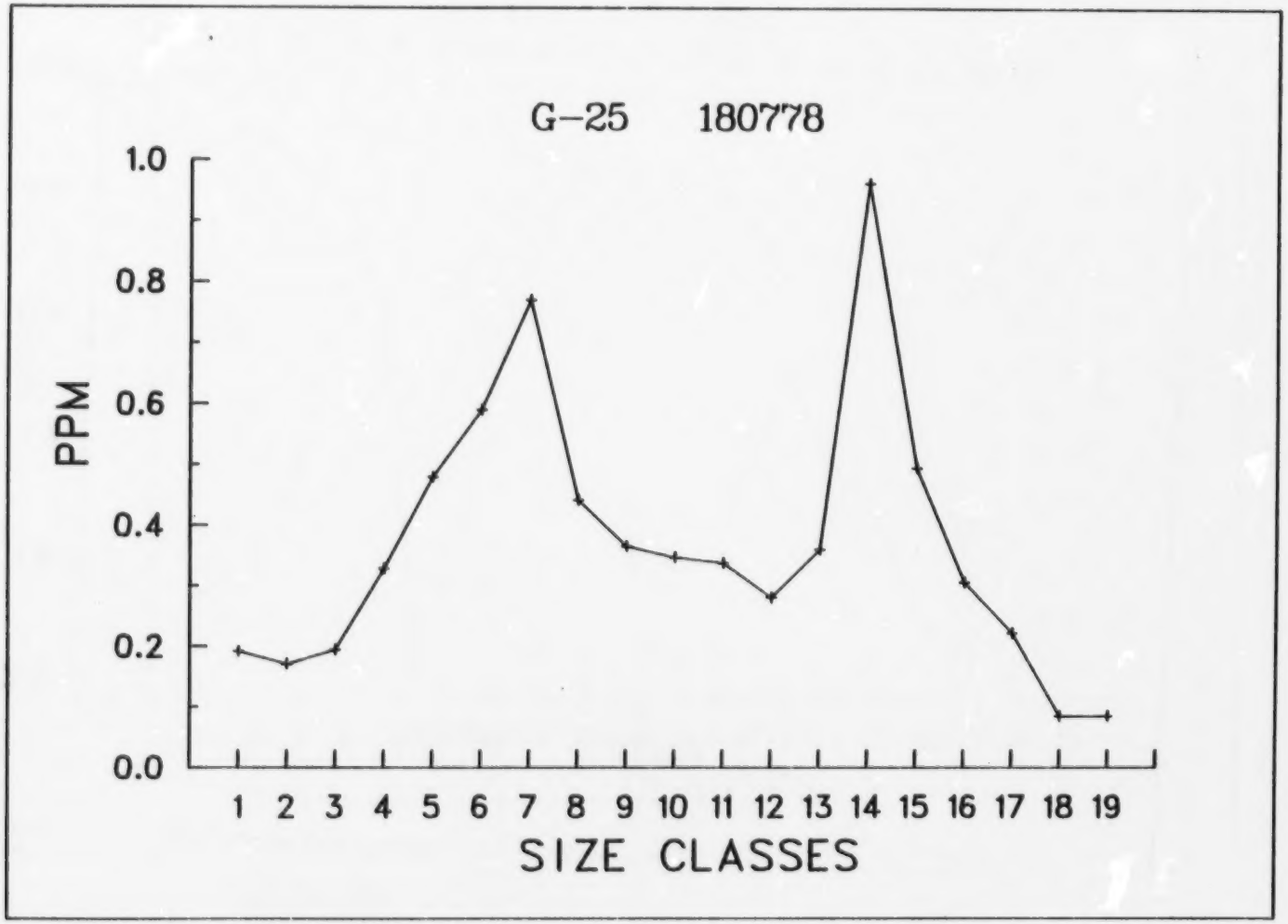
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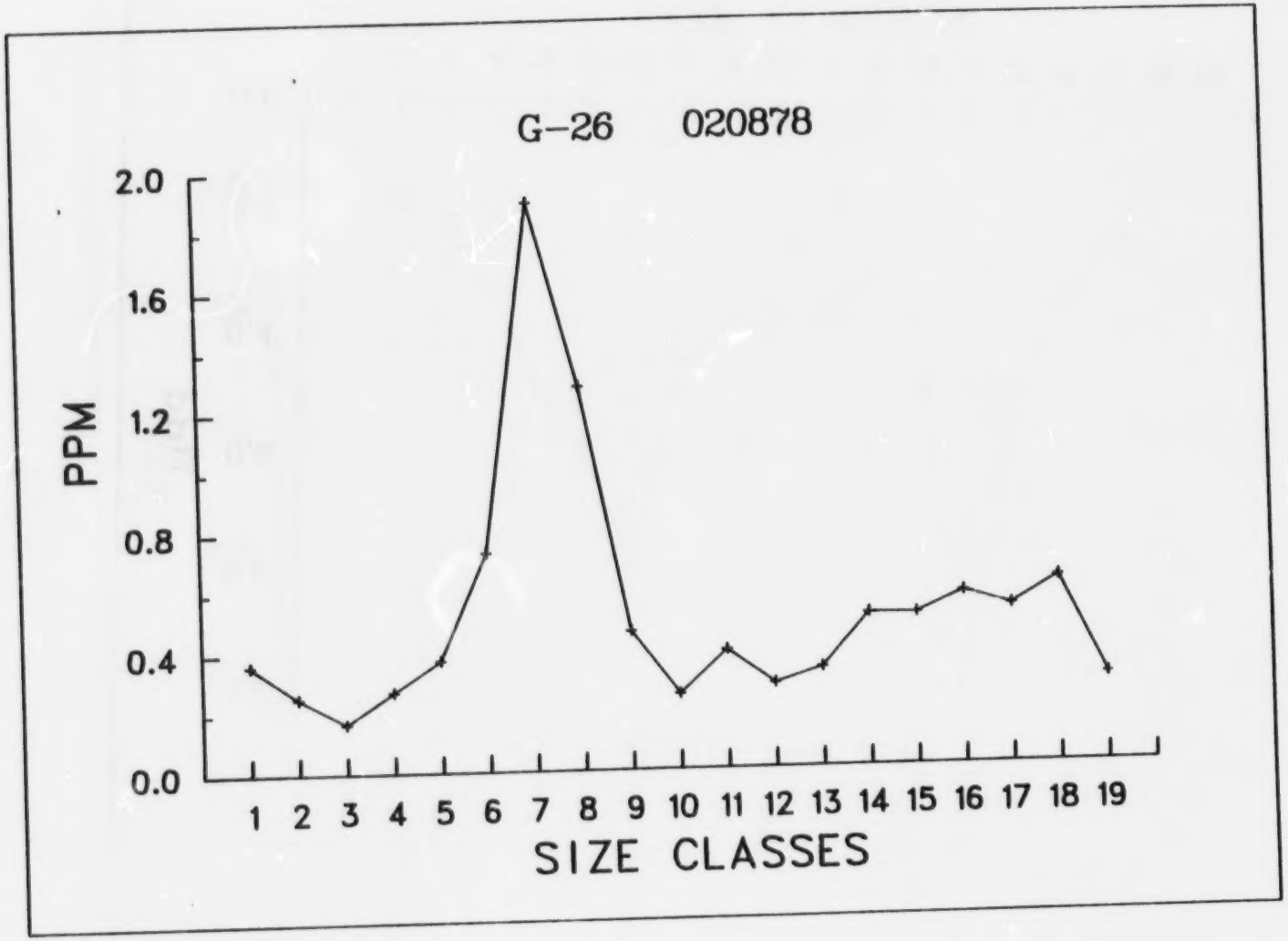
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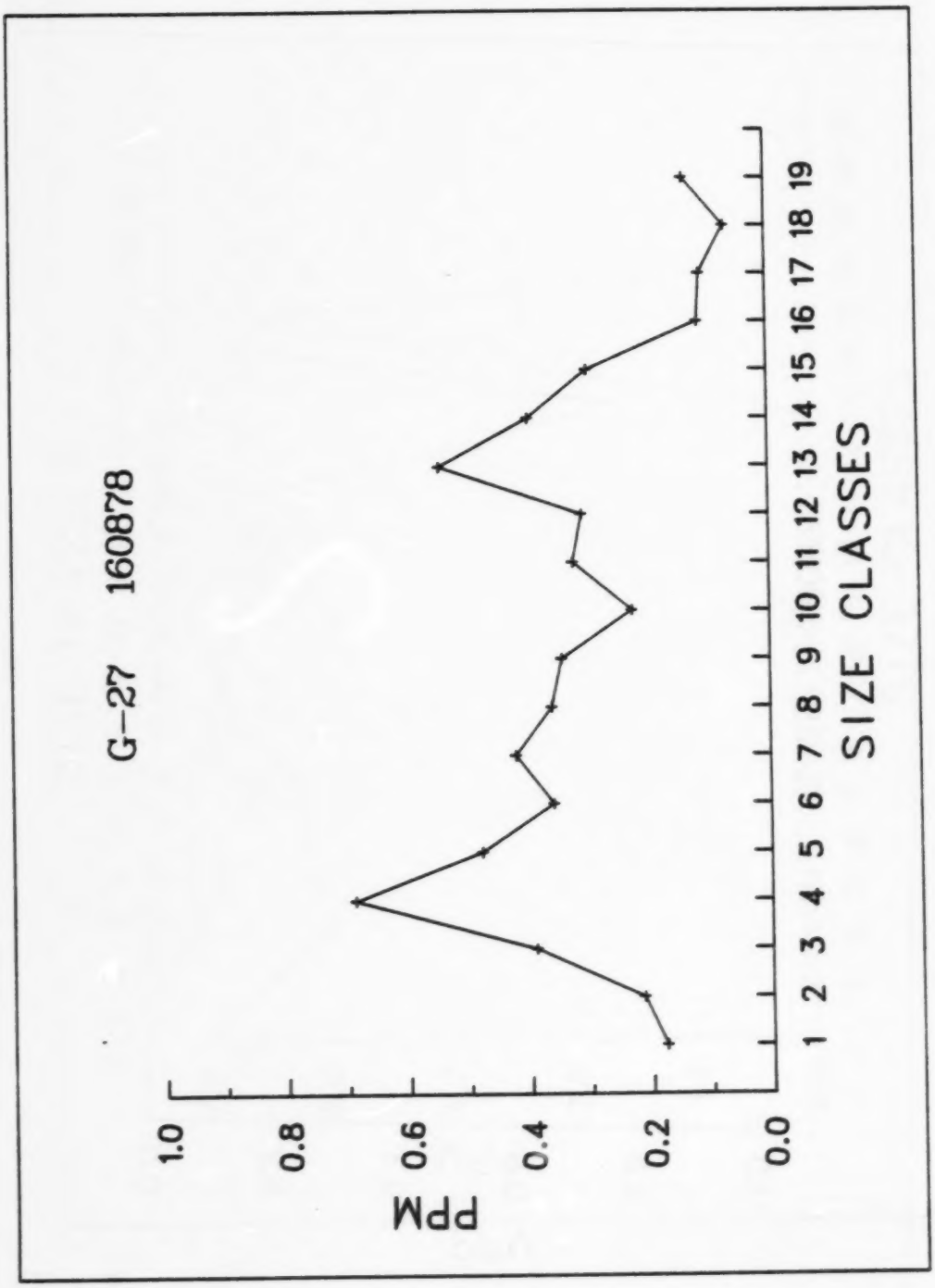
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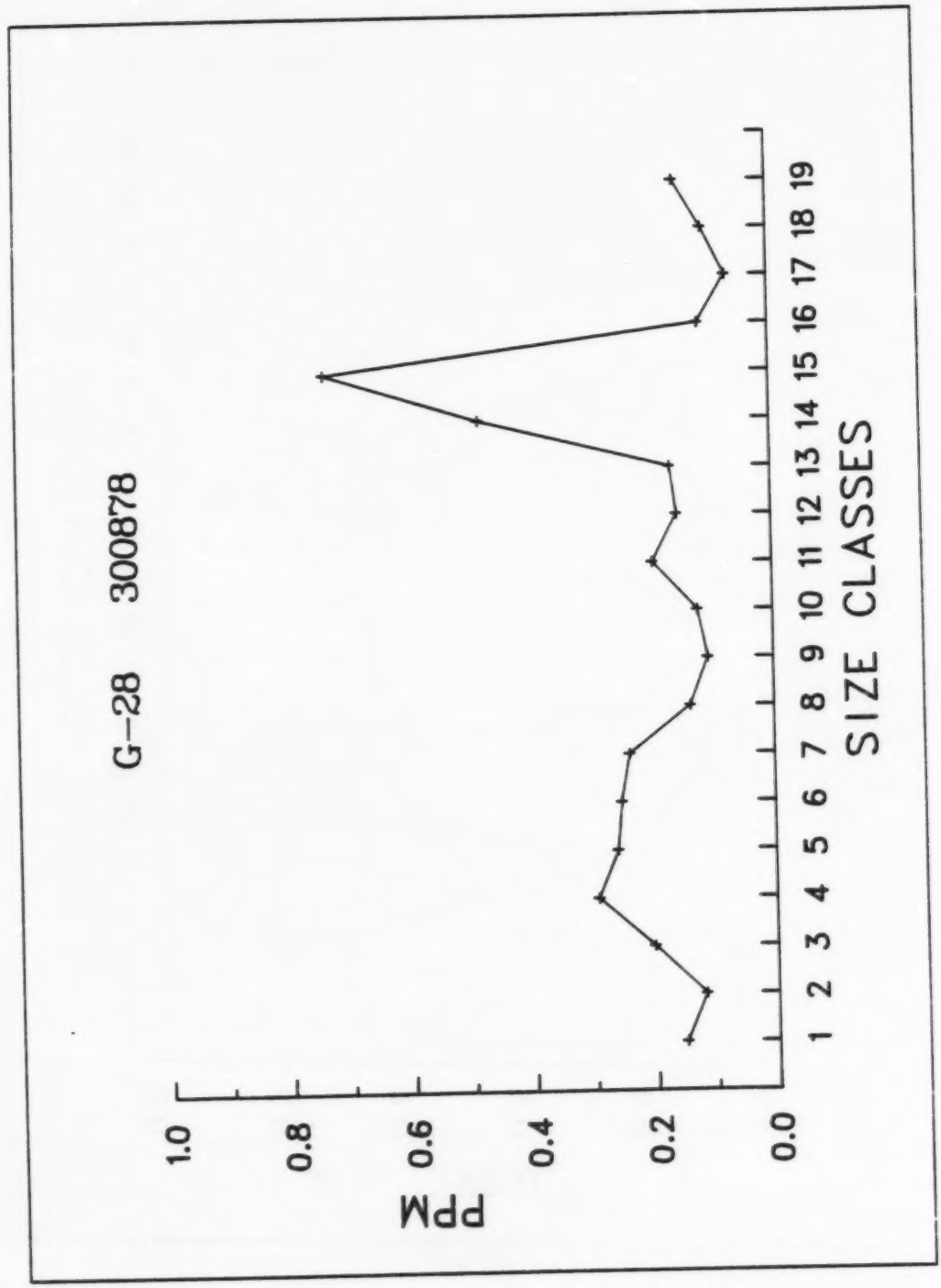
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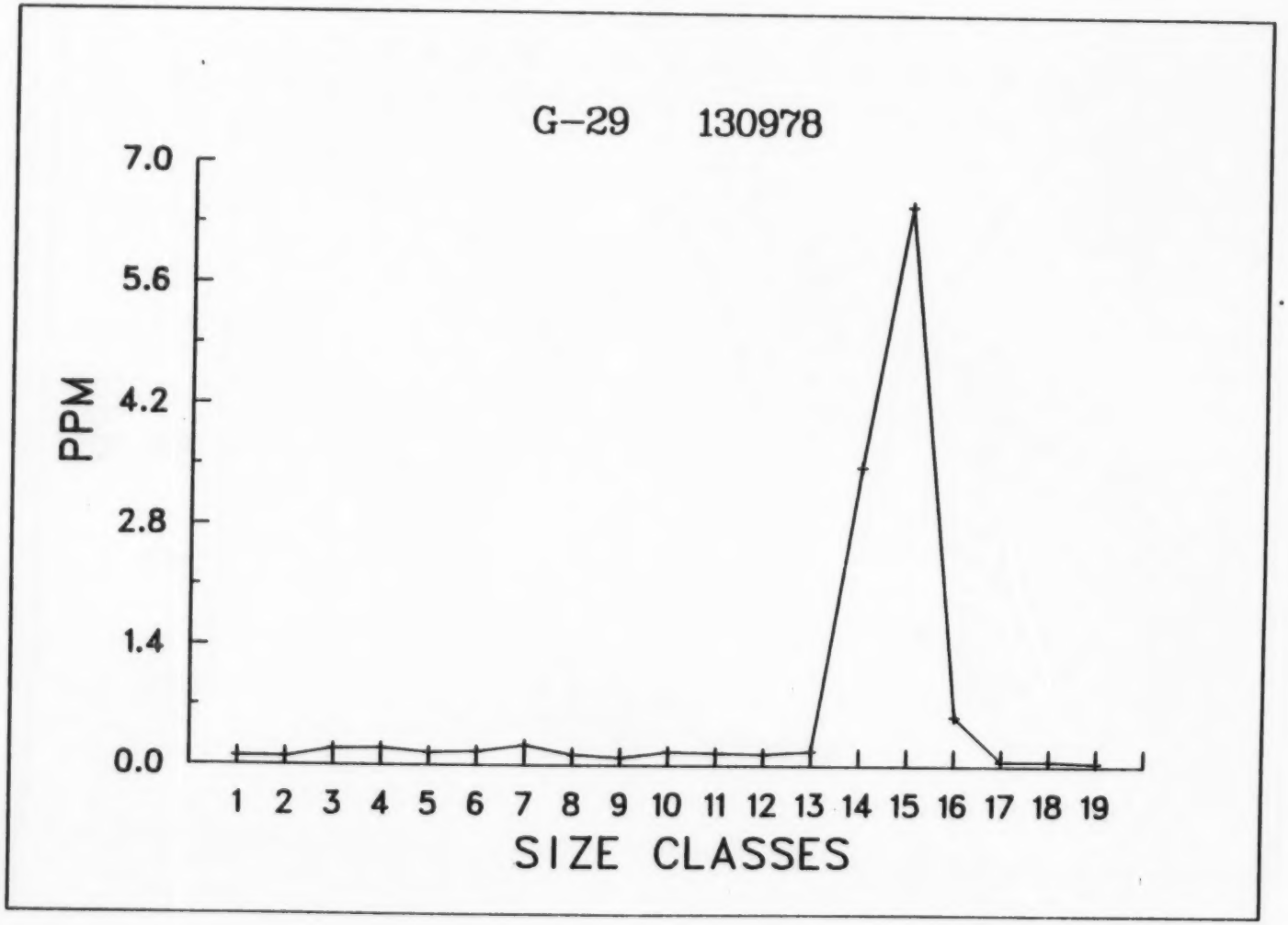
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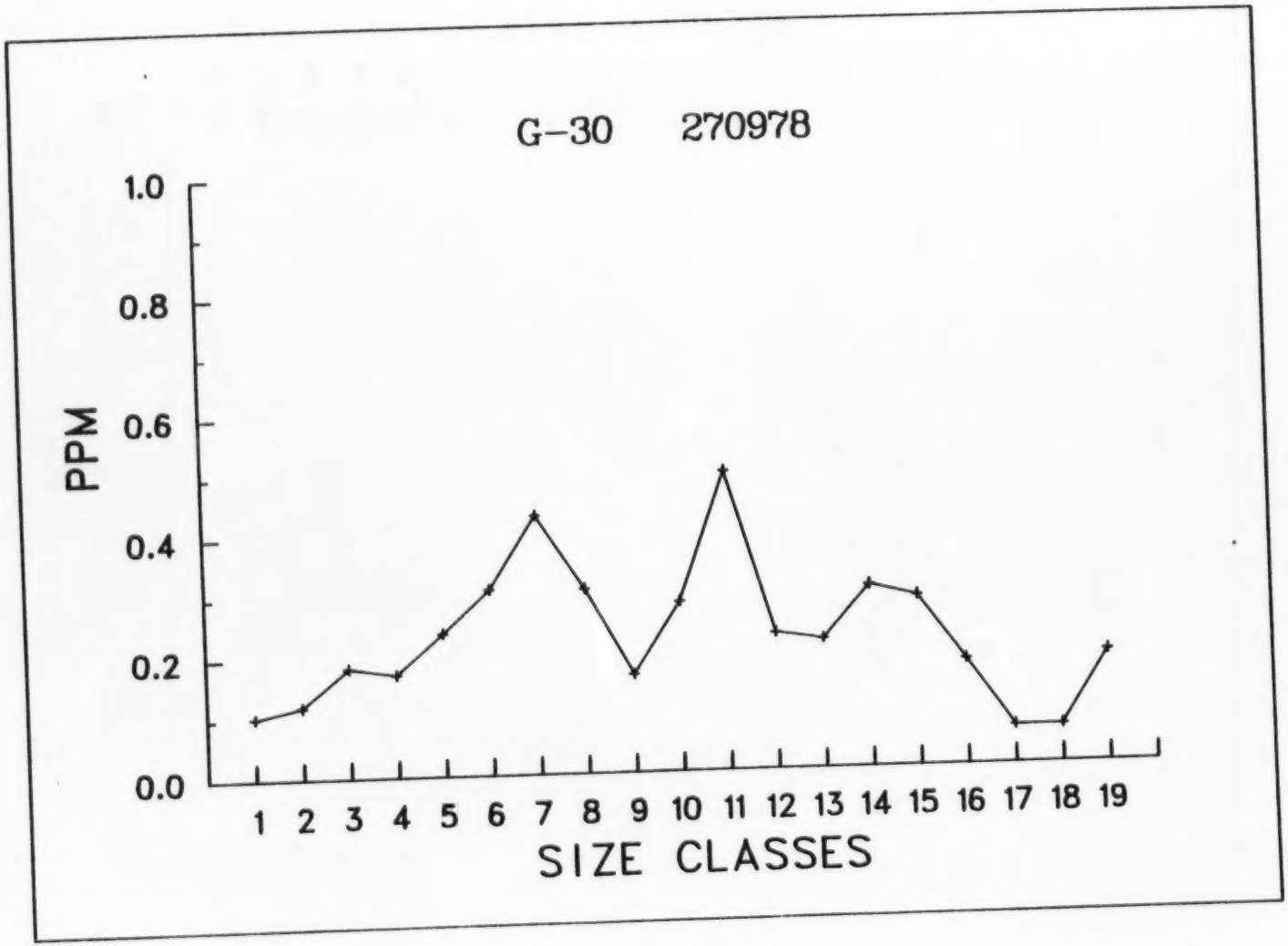
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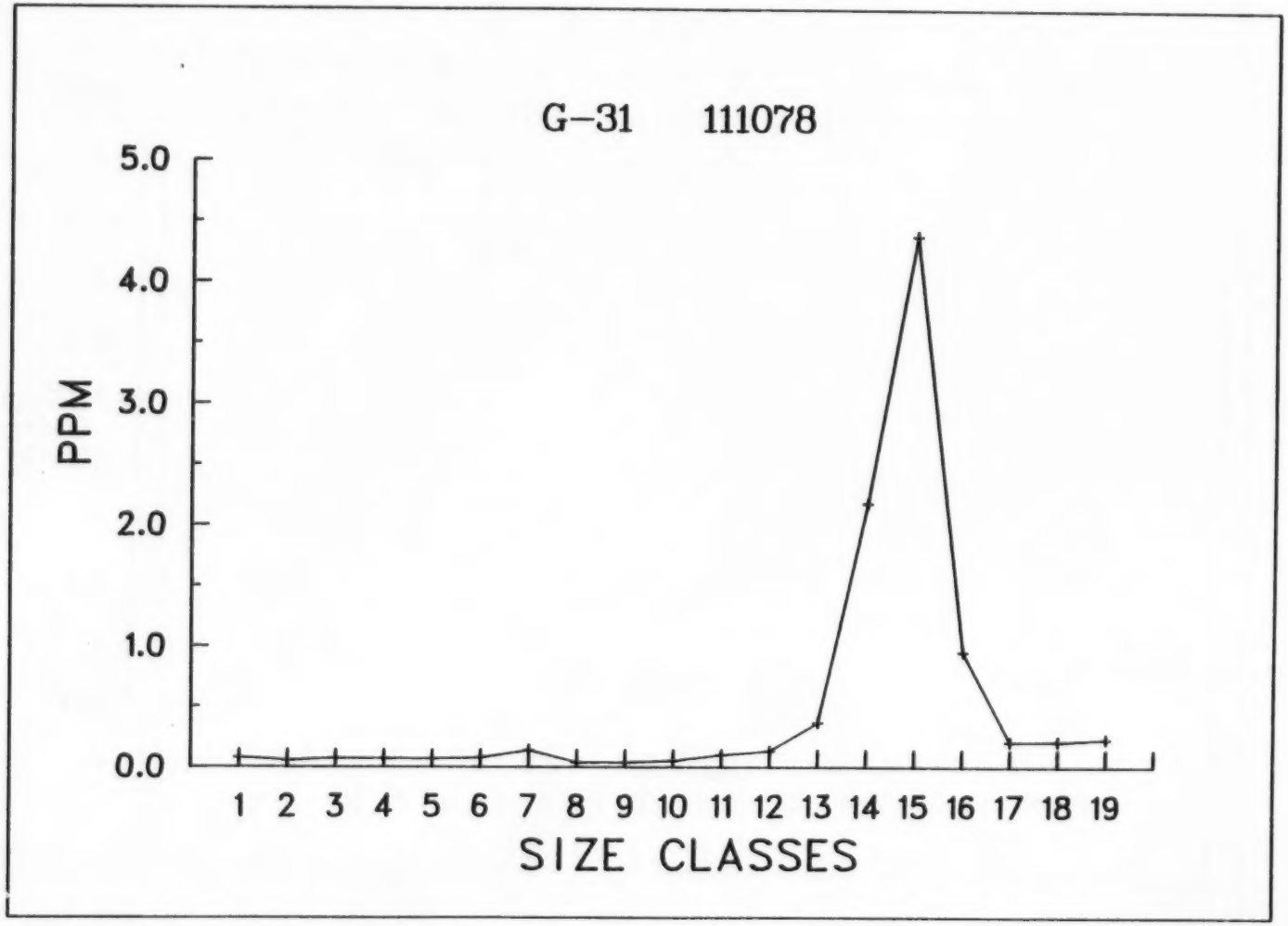
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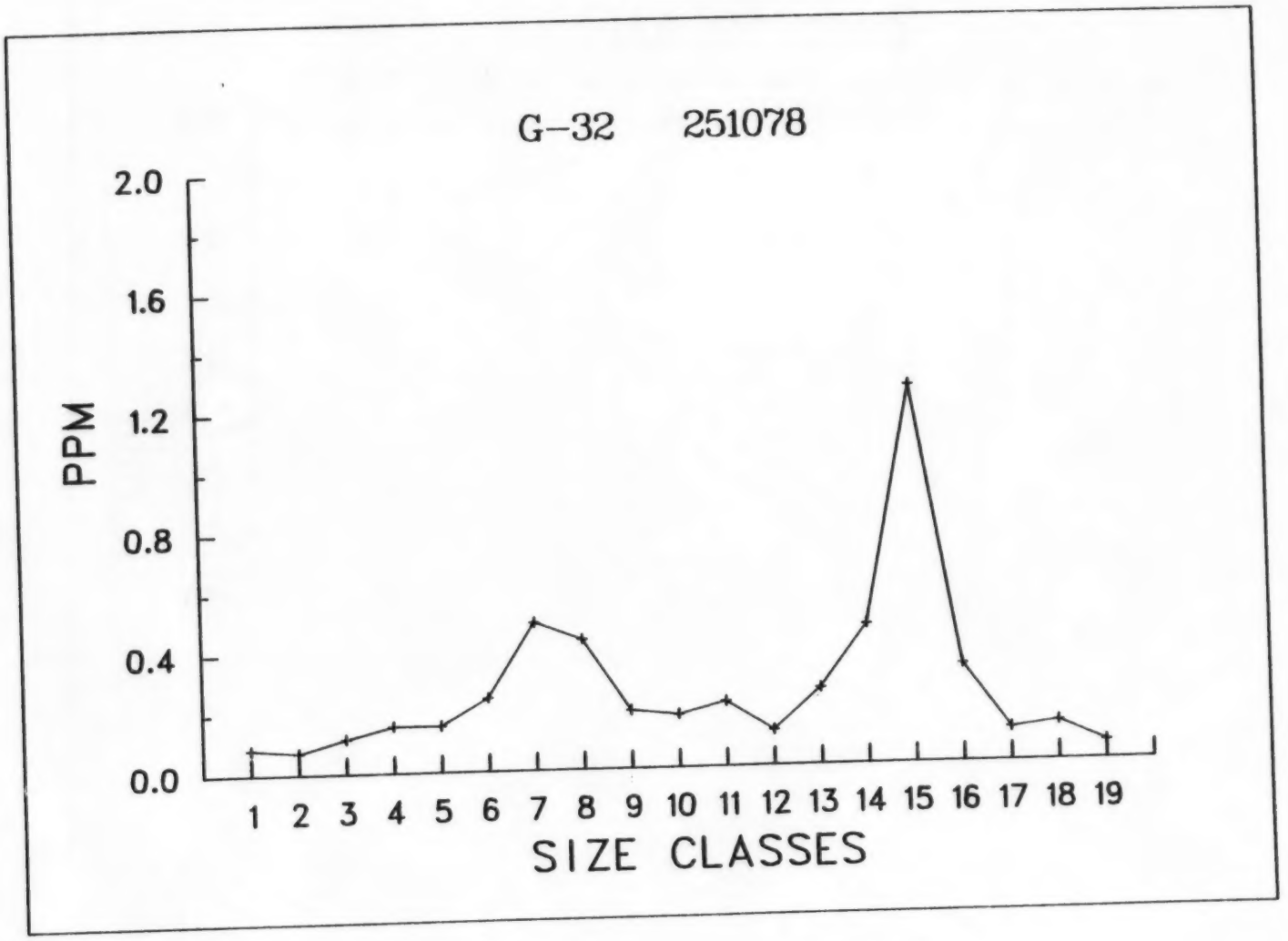
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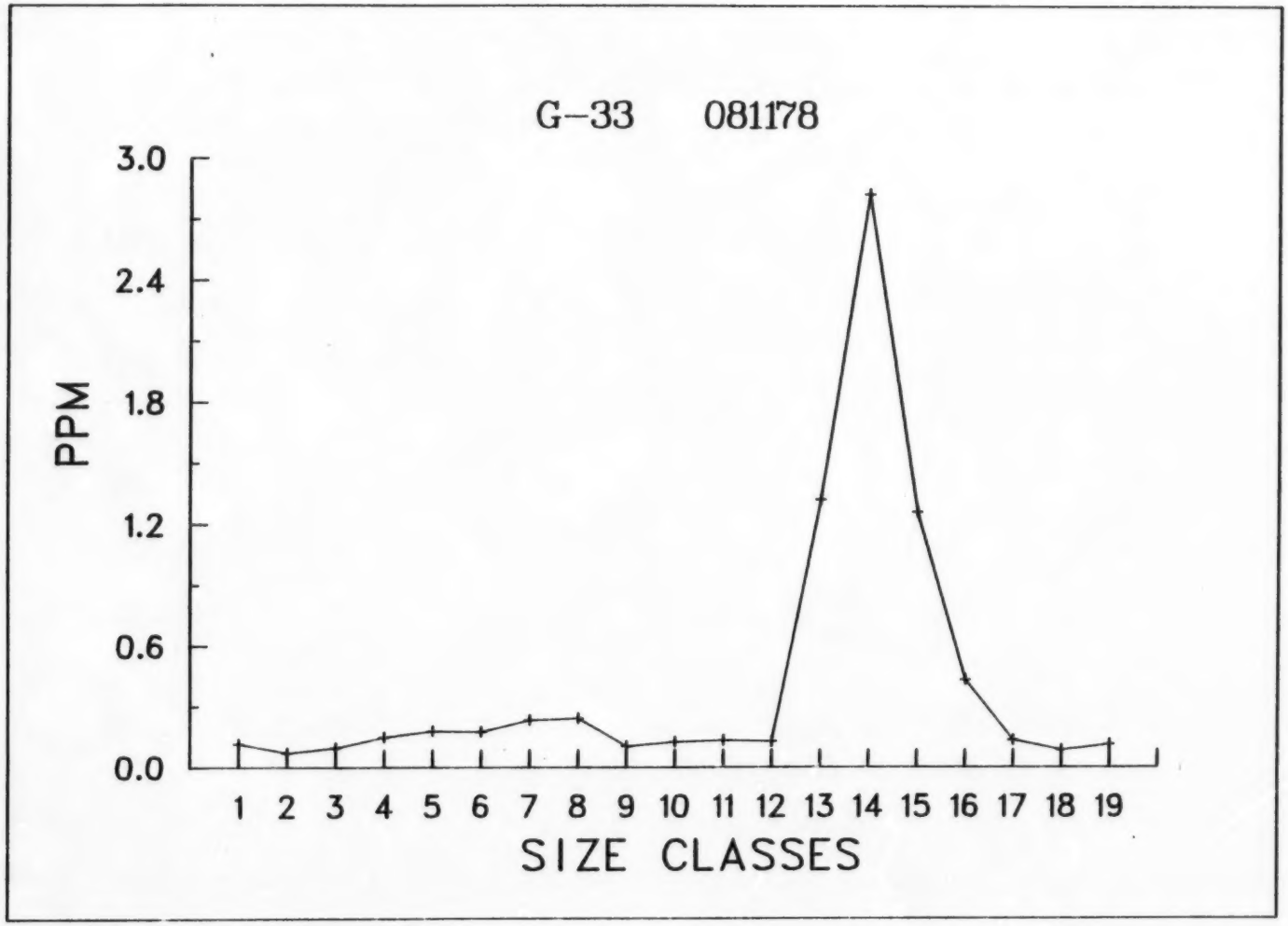
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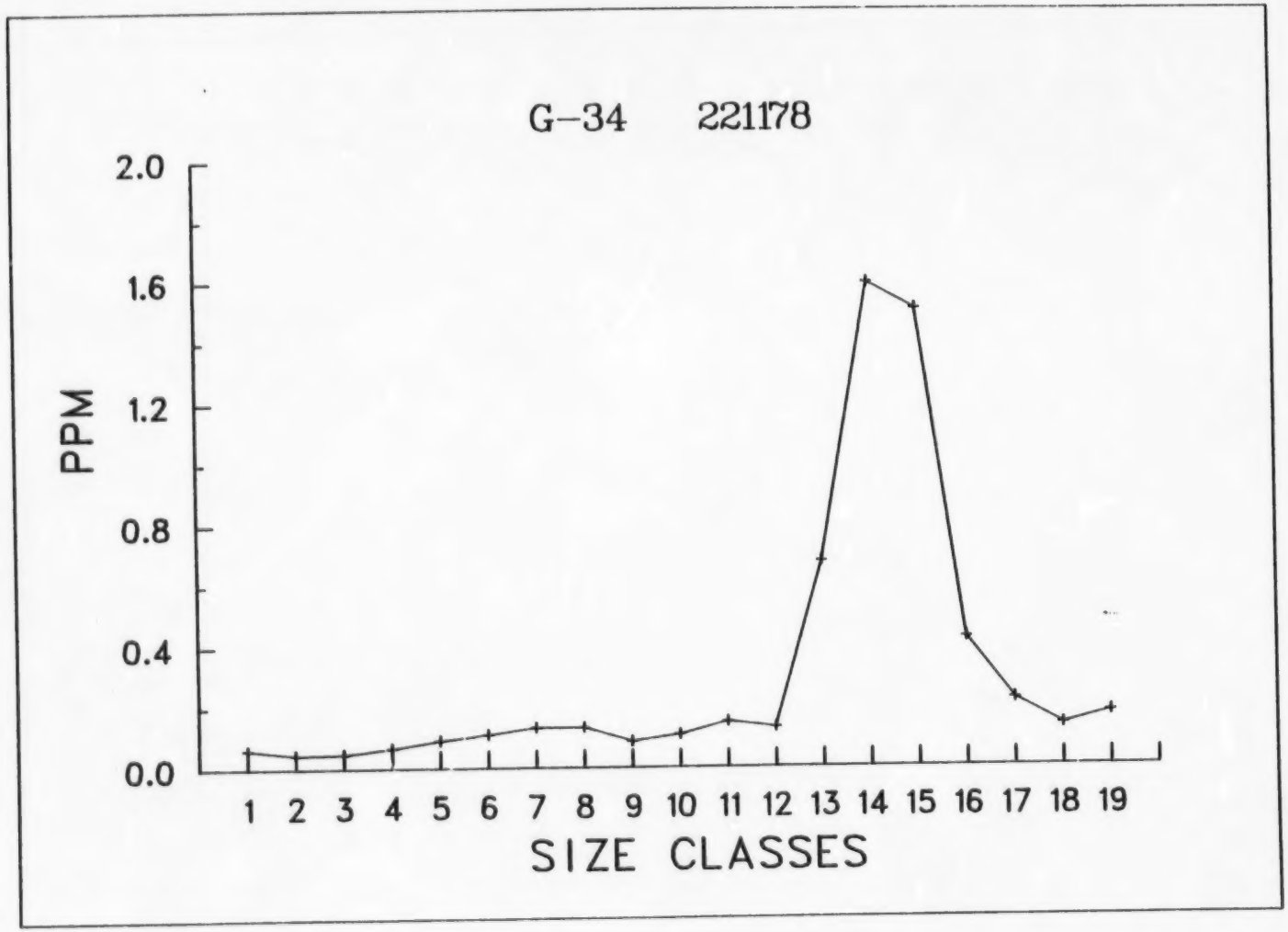
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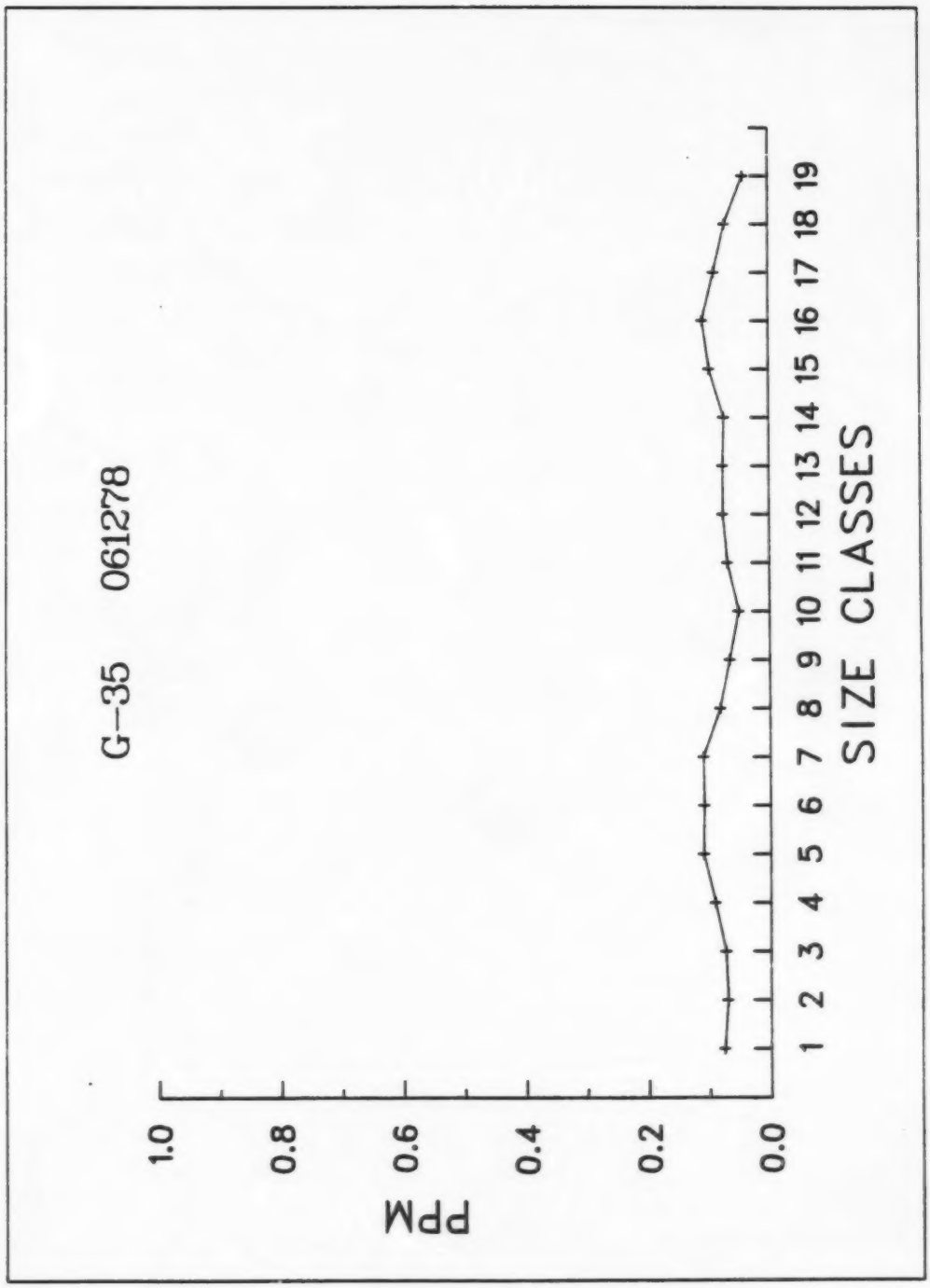
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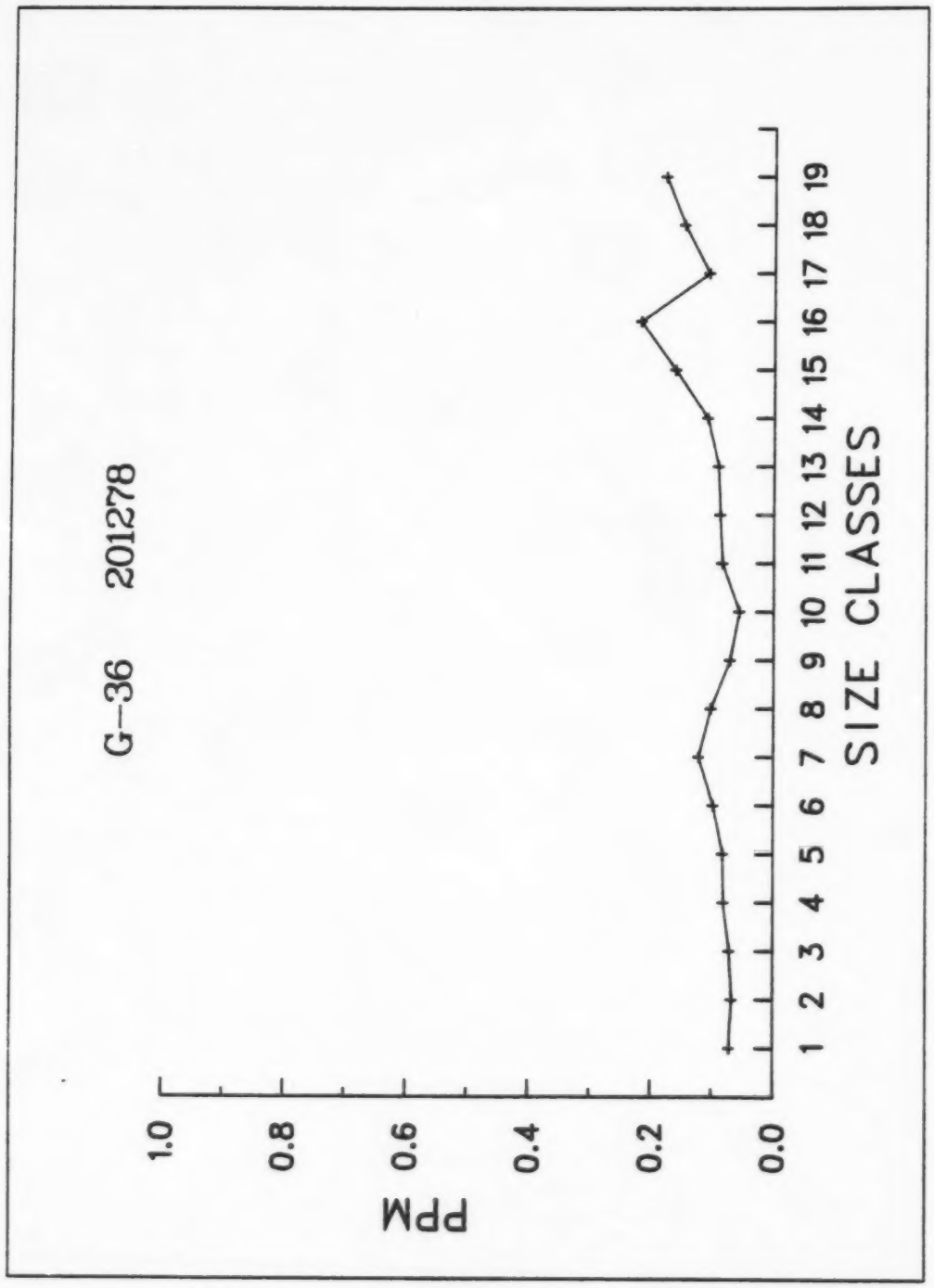
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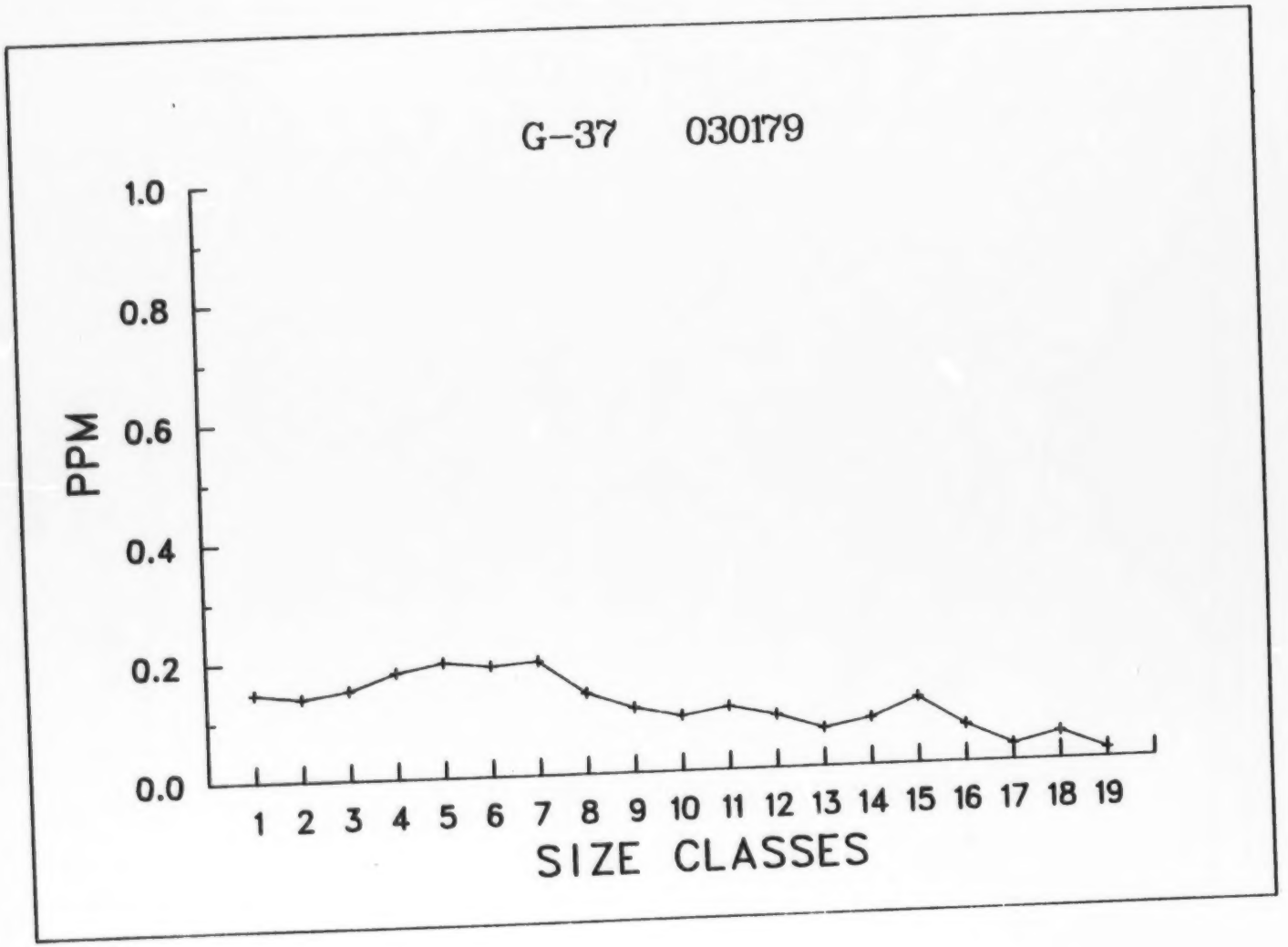
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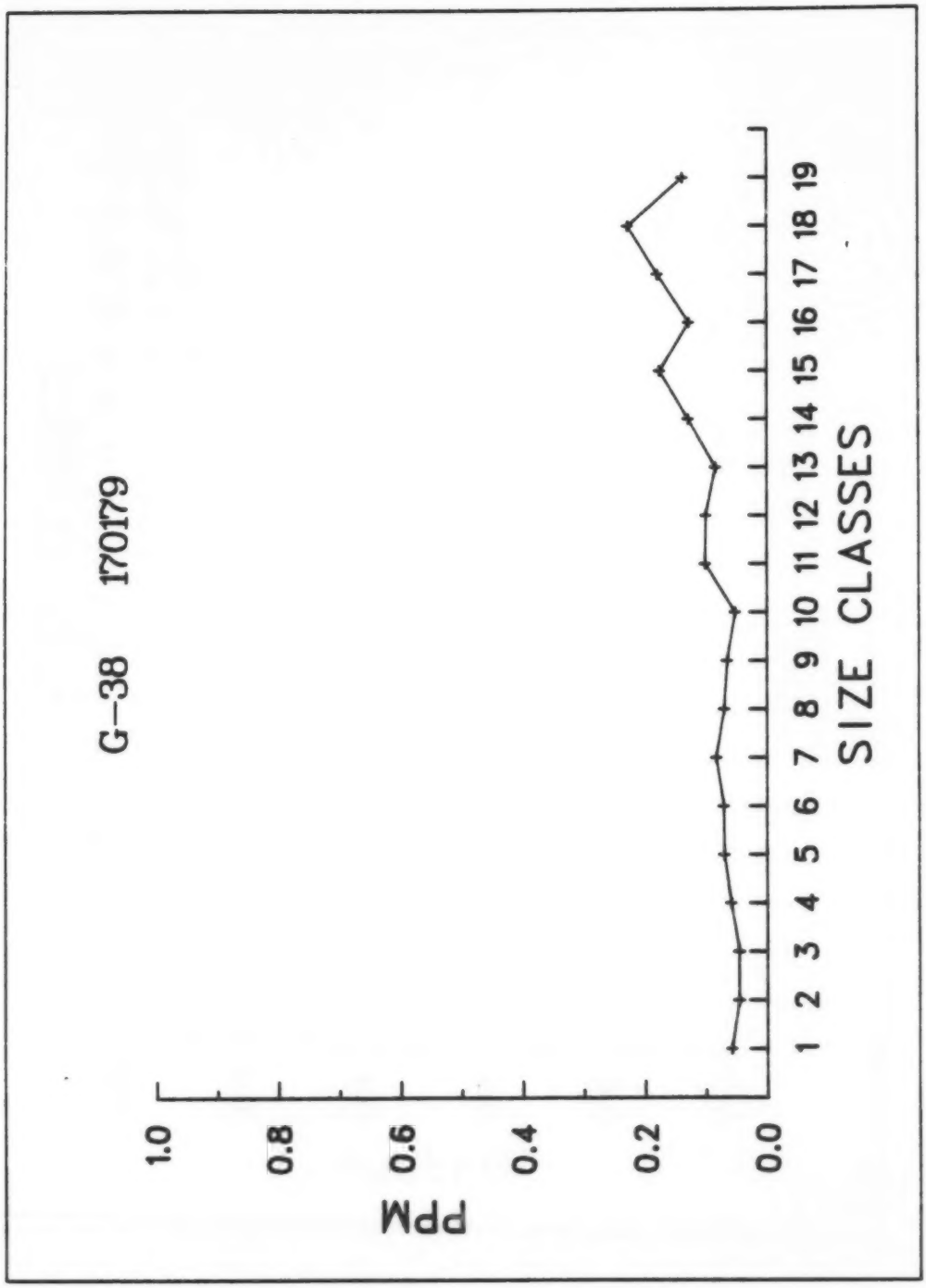
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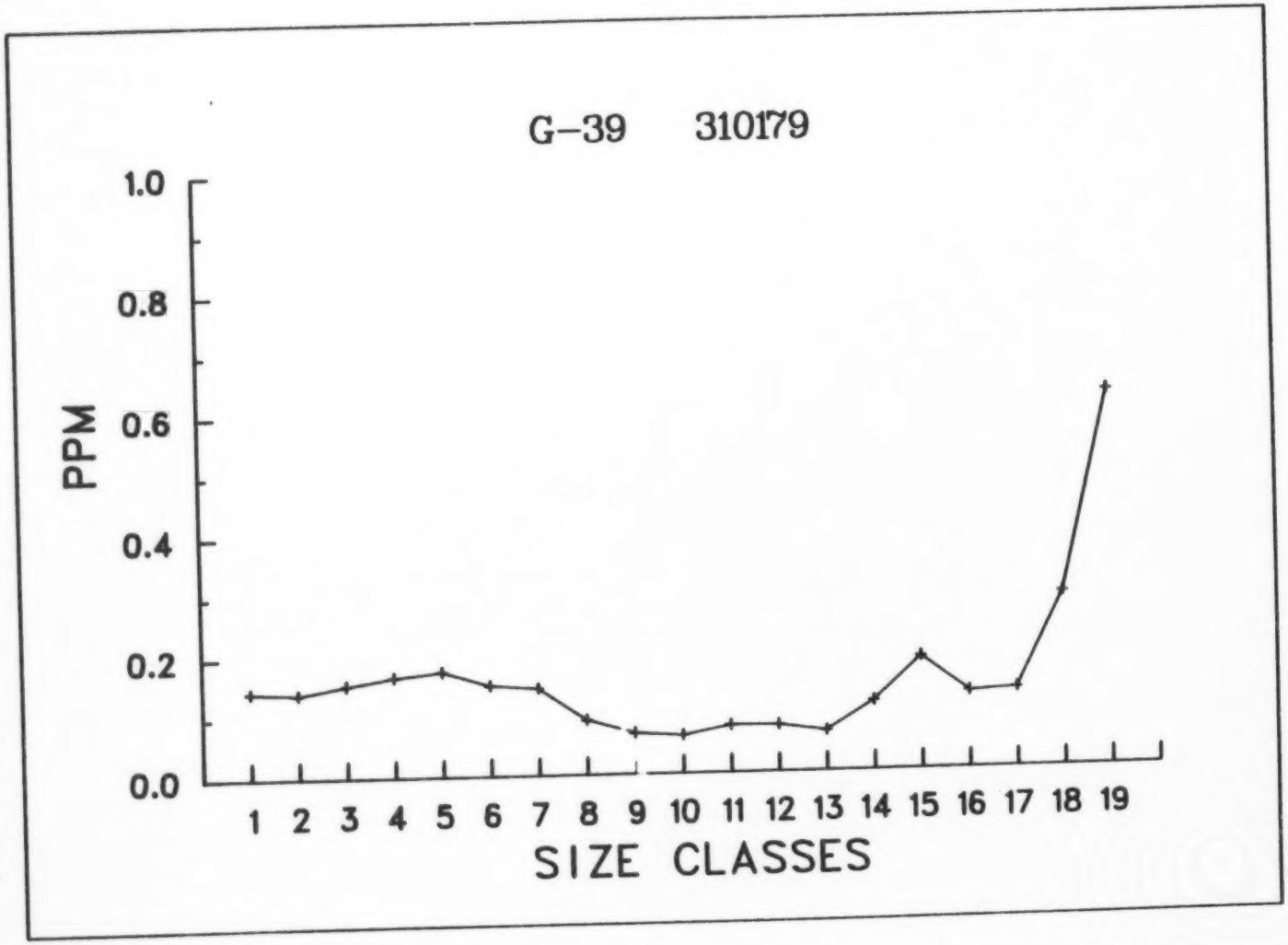
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SIZE CLASSES

POOR

QUALITY

ORIGINAL